APPENDIX.

Allegheny River Plan.

PIPE MAINS AND APPURTENANCES.

The pipe castings are estimated at 2¾ cents per pound. The special castings are estimated at 3¼ cents per pound.

1. *Low Service Mains.*

4,670 feet of 36 inch Force Mains laid, a $21	$ 98,070 00
Two 36 inch Check Valves set, a $2,200	4,400 00
200 cubic yards Arch Culvert masonry, a $15	3,000 00
10,500 cubic yards Embankment, a 35c	3,675 00
28,800 feet of 36 inch Distribution Main laid, a $16	460,800 00
Six 36 inch Stop Cocks, set, a $2,000	12,000 00
270 cubic yards Arch Culvert masonry, a $15	4,050 00
2,000 " " Embankment, a 35c	700 00
9,000 feet of 12 inch Distribution Main laid, a $3.40	30,600 00
Five 12 inch Stop Cocks, set, a $100	500 00
	$617,795 00

2. *Middle Service Mains.*

7,250 feet of 30 inch Distribution Main laid, a $11.75	$85,187 50
Three 30 inch Stop Cocks, set, a $1,000	3,000 00
1,150 feet of 24 inch Force Mains laid, a $9	10,350 00
Two 24 inch Check Valves, set, a $1,100	2,200 00
315 feet of 24 inch Distribution Main laid, a $8	2,520 00
8,400 feet of 20 inch Distribution Main laid, a $7	58,800 00
Six 20 inch Stop Cocks, set, a $400	2,400 00
3,600 feet of 15 inch Distribution Main laid, a $4.50	16,200 00
Two 15 inch Stop Cocks, set, a $200	400 00
	$181,057 50

3. *High Service Mains.*

12,500 feet of 12 inch Main laid, a $3.50	43,750 00
One 12 inch Check Valve, set, a $100	100 00
Eight 12 inch Stop Cocks, set, a $100	800 00
	$44,650 00
	$843,502 50
Add for Contingencies, Superintendence, etc., 10 per cent	84,350 50
	$927,853 00

BRILLIANT HILL RESERVOIR.

GRADING, SLOPE WALLS, &c.

Clearing and Grubbing..$	300 00
5,277 cubic yards stone paving of slopes, 12 inches thick, a $7.....	36,939 00
110 cubic yards stone coping at top of slope, a $18................	1,980 00
6,087 cubic yards concrete (5 inches thick on slopes and in bottom), a $6 50...	39,565 50
20,500 cubic yards puddle (2 feet thick on slopes and 1 foot thick on bottom), a 75c..	15,375 00
130,000 cubic yards excavation, a 30c.............................	39,000 00
24,700 square yards dressing and seeding of outside slopes, a 6c....	1,482 00
3,000 lineal feet of fencing, a 50c................................	1,500 00
	$136 141 50

MASONRY, &c.

INFLUENT CHAMBER.

50 cubic yards excavation, a 35c...................................$	17 50
17 cubic yards Masonry in foundation, a $12.......................	204 00
198 cubic yards Rubble Masonry, a $11.............................	2,178 00
18 cubic yards Ashlar, a $18......................................	324 00
3¼ cubic yards Coping, a $18. ....●.............	58 50
27 cubic yards Stone Paving, a $7.................................	189 00
4 square yards Brick Paving, a $1.56.............................	6 24
84 feet of 36 inch Straight Pipe (37,380 lbs.,) a 2½c.............	934 50
40 feet of Special Castings (18,000/lbs.,) a 3¼c.................	585 00
150 feet Waste Pipe, 8 inch diameter (8,550 lbs.,) a 2½c.........	213 75
	$4,710 49

CONNECTING WEIR.

3,724 cubic yards Excavation, a 35c...............................	$1,303 40
234 cubic yards Rubble Masonry, a $11............................	2,574 00
240 cubic yards Ashlar, a $18....................................	4,320 00
19 cubic yard Coping, a $18......................................	342 00
16 cubic yards Stone Paving, a $7................................	112 00
13 cubic yards Brick Paving, a $12...............................	156 00
102 cubic yards Concrete in foundation, a $6.50..................	663 00
	$9,470 40

EFFLUENT CHAMBER

210 cubic yards Excavation, a 35c.................................$	73 50
722 cubic yards Rubble Masonry, a $11............................	7,942 00
161 cubic yards Ashlar, a $18....................................	2,898 00
18 cubic yards Coping, a $18.....................................	324 00
30 cubic yards Stone Paving, a $7................................	210 00
12½ cubic yards Brick Paving, a $12..............................	150 00
6¼ cubic yards Flagging, a $15...................................	93 75
273 cubic yards Concrete in foundation, a $6.50.................	1,774 50
	$13,465 75

RECAPITULATION.

Grading, Slope Walls, &c..	$136,141 50
Influent Chamber...	4,710 00
Connecting Weir	9,470 40
Effluent Chamber	13,465 75
	$163,788 14
Add for Contingencies, &c., 10 per cent..........................	16,378 86
	$180,167 00

HILAND AVENUE RESERVOIR.

GRADING, SLOPE WALLS, &c.

Clearing and Grubbing...$	400 00
7,545 cubic yards Stone Paving of Slopes a $7....................	52,815 00
154 cubic yards Coping at top of Slopes, a $18..................	2,772 00
12,960 cubic yards Concrete, a $6 50............................	84,240 00
39,216 cubic yards Puddle, a 75c................................	29,412 00
175,000 cubic yards Excavation, a 30c...........................	52,500 00
29,900 Square yards Dressing and Seeding outside Slopes, a 6c....	1,794 00
3,460 Lineal feet of Fencing, a 50c.............................	1,730 00
	$225,663 00

INFLUENT CHAMBER.

50 cubic yards Excavation, a 35c.................................	17 50
17 cubic yards, masonry in foundation, a $12....................	204 00
198 cubic yards Rubble Masonry, at $11..........................	2,178 00
18 cubic yards Ashlar, a $18.....................................	324 00
3¼ cubic yards Coping, a $18....................................	58 50
27 cubic yards stone paving, a $7...............................	189 00
4 cubic yards brick paving, a $12...............................	48 00
84 feet of 30-inch straight pipe, 26,040 lbs; a 2½c.............	651 00
40 feet of special castings, 13,200 lbs, a 3¼c.................	429 00
90 feet of Waste Pipe 8 inches in diameter, 5,160 lbs a 2½c.....	129 00
	$4,228 00

EFFLUENT CHAMBER

920 cubic yards Excavation, *a* 35c..	322 00
52¼ cubic yards masonry in foundation, *a* $12............................	627 00
658 cubic yards Rubble masonry, *a* $11....................................	7,238 00
124½ cubic yards Ashlar, *a* $18...	2,241 00
8⅓ cubic yards Coping, *a* $18..	150 00
Brick Culvert 30 inches in diameter, 10,000 bricks, *a* $24 per thousand..	240 00
4 cubic yards Brick Paving, *a* $12...	48 00
8 cubic yards flagging of Gate Chamber, *a* $15.......................	120 00
12 cubic yards of Stone Paving at mouth of culverts, *a* $7..........	84 00
Screens and Screen Frames over Effluent pipes...........................	225 00
	$11,295 00

RECAPITULATION.

Grading, Slope Walls, &c...$	225,663 00
Influent Chamber..	4,228 00
Effluent Chamber..	11,295 00
	$241,186 00
Add for Contingencies, Superintendence, &c., 10 per cent....	24,118 00
	$265,304 00

HERRON HILL RESERVOIR.

GRADING, SLOPE WALLS, &c.

1,762 cubic yards Stone Paving of Slopes, *a* $7.........................	12,334 00
39 cubic yards Coping, *a* $18...	702 00
1,560 cubic yards Concrete, *a* $6.50......................................	10,140 00
5,660 cubic yards Puddle, *a* 75c...	4,245 00
30,730 cubic yards Excavation, *a* 80c....................................	9,219 00
12,900 cubic yards Excavation Shale, *a* 80c............................	10 320 00
12,400 square yards Dressing and Seeding outside Slopes, *a* 6c........	744 00
Foot Bridge 40 feet long...	200 00
Effluent Well, Cast Iron, 30 in diameter and 24 feet long, 8,000 lbs, *a* 5c...	400 00
Three Valves and Valve Rods, *a* $50......................................	150 00
2,100 lineal feet of Fencing, *a* 50c.......................................	1,050 00
	$49,504 00
Add for Contingencies, Superintendence, &c., 10 per cent.............	4,950 00
	$54,454 00

ALLEGHENY RIVER PLAN.

COST OF WORKS.

Pumping engines to be located at Negley's run. Water to be taken from the Allegheny River, at the head of Nine Mile Island, and conducted to engines through a brick conduit six feet in diameter.

Masonry at Influent Chamber of Conduit, with Influent pipes, Gates and Screens...	7,000 00
16,400 feet of Conduit six feet in diameter, *a* $17...................	278,800 00
12 Manholes, *a* $75..	900 00
Engine house and Pump Well at Negley's run.............................	150,000 00
Two pumping engines, *a* $150.000..	300,000 00
Engine house at Brilliant Hill..	35,000 00
Two pumping engines, *a* $35,000...	70,000 00
Engine house and engine at Ellsworth avenue and Neville street....	25,000 00
Brilliant Hill Reservoir..	180,167 00
Hiland Avenue Reservoir..	265,304 00
Herron Hill Reservoir..	54,454 00
Pipe mains and appurtenances...	927,853 00
	$2,294,478 00

ALLEGHENY RIVER PLAN.

COST OF WORKS.

Pumping works to be located at Negley's run. Water to be taken from the Allegheny river in rear of the engine house about 800 feet above the mouth of Negley's run.

Engine house and Pump Well at Negley's run...................$	150,000 00
Two pumping engines, *a* $150,000..	300,000 00
Engine house at Brilliant Hill...	35,000 00
Two pumping engines, *a* $35,000..	70,000 00
Engine House and engine at Ellsworth avenue and Neville street..	25,000 00
Brilliant Hill Reservoir..	180,167 00
Hiland Avenue Reservoir..	265,304 00
Herron Hill Reservoir..	54,454 00
Pipe Mains and Appurtenances	927,853 00
One and one-half miles of Brick Sewer 2 feet in diameter............	31,720 00
	$2,039,498 00

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PIPE MAINS AND APPURTENANCES.

1. *Low Service Mains.*

4,650 feet of 36 inch Force Main laid, *a* $19.............$ 88,350 00	
Two 36 inch Check Valves set, *a* $2,200............	4,400 00
Arch Culvert and Embankment at Four Mile run.....	5,000 00
20,000 feet of 36 inch Distribution Main laid, *a* $16.65..	333,000 00
Four 36 inch Stop Cocks set, *a* $2,000......	8 000 00
4,450 feet of 20 inch Distribution Main laid, *a* $6.40...	28,480 00
Three 20 inch Stop Cocks set, $400......	1,200 00
9,000 feet of 12 inch Distribution Main laid, *a* $3.40...	30,600 00
Five 12 inch Stop Cocks set, *a* $100............	500 00
	——— $499,530 00

2. *Middle Service Mains.*

8,250 feet of 30 inch Distribution Main laid, *a* $12...	99,000 00
Four 30 inch Stop Cocks set, *a* $1,000......	4,000 00
12,150 feet of 20 inch Distribution Main laid, *a* $6.40.	77,760 00
Eight 20 inch Stop Cocks set, *a* $400.......	3,200 00
4,400 feet of 30 inch Distribution Main laid, *a* $11.50	50,600 00
Two 30 inch Stop Cocks set, *a* $1,000........	2,000 00
3,600 feet of 15 inch Distribution Main laid, *a* $4.50..	16,200 00
Two 15 inch Stop Cocks set, *a* $200...........	400 00
	——— $ 253,160 00

3. *High Service Mains.*

12,500 feet of 12 inch Mains laid, *a* $3.50...........	43,750 00
One 12 inch Check Valve set, *a* $100......	100 00
Eight 12 inch Stop Cocks set, *a* $100........	800 00
	——— $44,650 00
	$797,340 00
Add for Contingencies, Omissions, Superintendence, &c., 10 per cent............	79,734 00
	$877,074 00

ARTHUR AND CRAFT'S HILL RESERVOIR.
GRADING, SLOPE WALLS, &c.

Grubbing and Clearing............$	250 00
6,856 cubic yards Stone Paving, *a* $7...........	47,992 00
141 cubic yards Coping, *a* $18........	2,538 00
11,526 cubic yards Concrete, at $6.50...........	74,919 00
35,100 cubic yards Puddle, *a* 75c...........	26,325 00
197,800 cubic yards Excavation, 30c...........	59,840 00
30,550 square yards Dressing and Seeding outside Slopes, *a* 6c......	1,833 00
4,720 lineal feet of Fencing, *a* 50c........	2,360 00
	$215,557 00

INFLUENT CHAMBER.

Total cost...........	5,000 00

EFFLUENT CHAMBER.

2,000 cubic yards Excavation, *a* 35c.........$	700 00
139 cubic yards Masonry, *a* $12........	1,668 00
1,316 cubic yards Rubble Masonry, *a* $11......	14,476 00
420 cubic yards Ashlar, *a* $18........	7,560 00
30 cubic yards Coping, *a* $18..	540 00
120 square yards Brick Paving, *a* $1.50........	180 00
	$25,124 00

RECAPITULATION.

Grading, Slope Walls, &c...........	$215,557 00
Influent Chamber...........	5,000 00
Effluent Chamber...........	25,124 00
	$245,681 00
Add for Contingencies, Superintendence, &c., 10 per cent...........	24,568 00
	$270,249 00

WILKINS HILL RESERVOIR.
GRADING, SLOPE WALLS, &c.

6,000 cubic yards Stone Paving, *a* $7...... $	42,000 00
125 cubic yards Coping, *a* $18........	2,250 00
8,340 cubic yards Concrete, *a* $6.50...........	54,210 00
26,000 cubic yards Puddle, *a* 75c...........	19,500 00
180,000 cubic yards Excavation, *a* 30c...........	54,000 00
24,400 square yards of Dressing and Seeding outside Slopes, *a* 6c...	1,704 00
4,120 lineal feet of Fencing, *a* 50c...........	2,060 00
	$175,724 00

INFLUENT CHAMBER.

Total cost...........	$4,000 00

EFFLUENT CHAMBER.

Total cost...........	$12,000 00

RECAPITULATION.

Grading, Slope Walls, &c...........	$175,724 00
Influent Chamber...........	4,000 00
Effluent Chamber...........	12,000 00
	$191,724 00
Add for Contingencies, Superintendence, &c., 10 per cent...........	19,172 00
	$210,896 00

MONONGAHELA RIVER PLAN.

COST OF WORKS.

Pumping engines to be located at Four Mile run. Water to be taken from Pool No. 2 and conducted to engines through a circular brick conduit six feet interior diameter.

Masonry, gates, &c., at inlet to Conduit.........................$	5,000 00
41,700 lineal feet of Conduit, a $17.............................	708,900 00
32 Manholes, a $75..	2,400 00
Engine House and Pump Well.................................	150,000 00
Two Pumping Engines, a $150,000...........................	300,000 00
Engine House at Arthur and Craft's Hill.....................	35,000 00
Two Pumping Engines, a $35,000............................	70,000 00
Stand Pipe...	40,000 00
Engine House and Engine at Ellsworth Avenue and Neville Street.......	25,000 00
Reservoir—Arthur and Craft's Hill..........................	270,249 00
Reservoir—Wilkins Hill....................................	210,896 00
Reservoir—Herron Hill.....................................	54,454 00
Pipe Mains and appurtenances..............................	877,074 00
	$2,748,973 00

MONONGAHELA RIVER PLAN.

COST OF WORKS.

Pumping Engines to be located at Four Mile run. Water to be taken from Pool No. 1, directly in rear of Engine House.

Engine House and Pump Well................................$	150,000 00
Two Pumping Engines, a $150,000...........................	300,000 00
Engine House at Arthur and Craft's Hill.....................	35,000 00
Two Pumping Engines, a $35,000............................	70,000 00
Stand Pipe...	40,000 00
Engine House and Engine at Ellsworth avenue and Neville street	25,000 00
Reservoir—Arthur and Craft's Hill..........................	270,249 00
Reservoir—Wilkins Hill....................................	210,896 00
Reservoir—Herron Hill.....................................	54,454 00
Pipe Mains and appurtenances..............................	877,074 00
	$2,032,673 00

REPORT OF OTTO WUTH,

Analytical and Consulting Chemist, corner of Third avenue and Smith-field street.

PITTSBURGH, March 3d, 1871.

GENTLEMEN :—In September last you requested me to make a thorough analysis of the water from the two rivers enclosing the City of Pittsburgh, and from their principal contributaries, in order to ascertain the amount and character of the impurities in either, so as to establish their respective value for supplying the new City Water Works to be built under your direction.

Of each water you furnished me with two carboys, marked respectively, 5 and 6 (Monongahela), 7 and 8 (Allegheny), 9 and 10 (Kiskiminitis), 11 and 12 (Youghiogheny).

Having completed the analysis according to your wishes, I have now the honor to communicate to you the result of my researches.

With the exception of the water in 5 and 6, which contained some silicate of alumina (clay,) in suspension, retaining a slight opaqueness even after several weeks standing, all samples were perfectly clear; none of them showed the presence of oil, neither the waters themselves nor the distillate therefrom.

Some of each sample I have kept until the present time, taking no particular care to exclude the influence of the atmospheric air, but they all are as fresh now as they were on the day I received them.

In 100,000 parts the different waters contain :

	Mononga-hela.	Allegheny.	Kiskimin-itis.	Youghio-gheny.
Cloride of Potassium	0.0411	0.1103	0.0602	0.0521
Chloride of Sodium	0.2541	0.6283	0.3184	0.2913
Sulphate of Soda	1.0135	0.3758	0.5987	0.8706
Sulphate of Lime	0.1598	0.3662	0.4743	0.0817
Bicarbonate of Lime	3.7390	3.6393	2.4961	4.0675
Bicarbonate of Magnesia	1.5232	1.8528	1.2717	1.7280
Silica	0.2678	0.1351	0.1260	0.1306
Organic Carbon	0.3710	0.2761	0.1712	0.2324
Organic Nitrogen	0.0120	0.0051	0.0030	0.0054
Nitrogen as Nitrates and Nitrites, Ammonia, } Traces only	....	....	....	....
Total residue dried at 160 degrees Celsius	6.0553	5.9402	4.5452	5.8810
Residue in grains per U. S. gallon of 231 cubic inches	3.5311	3.4640	2.6505	3.4290
Hardness	3.14	2.98	2.31	3.24

When dried at 160 degrees Celsius, the Bicarbonate of Lime is converted into the neutral Carbonate; the Bicarbonate of Magnesia into the basic Carbonate $[3\,C\,O_2 + 4\,Mg.\,O + 4\,H_2O]$.

If you compare these waters with any of those furnished to the cities of New York, Brooklyn, and Boston, in the United States, or to those furnished to several larger English cities, you will find that they are at least equal to the very best of them.

I have the honor to sign,

Yours most respectfully,

[Signed.]

O. WUTH.

To Messrs.

Gen. J. K. MOORHEAD,
F. SLATAPER, C. E.,
GEO. A. BERRY, Esq. } Water Commissioners.

NOTE—

The water for analysis was taken from the different streams at the points named below:

From the Allegheny at Nine Mile Island; September 20th, 1870.

From the Kiskiminitis at a point about three miles from its mouth, and about one half mile above Hill's Mill; September 21st, 1870.

From the Monongahela at a point in Pool No. 1, opposite City Farm; September 20th, 1870.

From the Youghiogheny at Alpsville, about twenty-one miles from Pittsburgh; September 22d, 1870.

Table showing Grains of Solid Matter in one U. S. gallon of water, in different cities in America and Europe.

Source.	City Supplied.	Grains of Solid Matter in one U. S. Gallon.	
Croton	New York	4.16	
Schuylkill	Philadelphia	4.42	
Long Island Streams	Brooklyn	1.97	
Cochituate	Boston	2.25	{ Different analyses vary from 1.22 to 5.00
Jones Falls	Baltimore	5.85	
Potomac River	Washington	5.59	
Passaic River	Jersey City	7.44	
Patroon's Creek	Albany	4.72	
Detroit River	Detroit	5.72	
Lake Michigan	Chicago	8.01	
Ohio River	Cincinnati	6.74	Vary from 4.74 to 6.74
St. Charles River	Quebec	6.75	
Thames River	London	17.97	Great variations.
Seine River	Paris	10.00	
Elbe River	Dresden	21.00	
Loch Katrine	Glasgow	1.85	

Description of Engines.

By GEORGE M. COPELAND, Mechanical Engineer.

The Engine, the drawing of which is herewith presented, is of the Compound, or Double Cylinder variety, connected by the usual means to a pair of overhead beams, and through these, and the Connecting Rod, to the Crank and Fly-wheel shaft.

PUMP CONNECTION.

Connection to the Pump is made from near the opposite end of the beams from the cylinders, and just inside of (or nearer the centre of the engine than) the pin in the end of the beams, to which the connecting rod is attached.

PUMP.

The Pump, which is of the Thames-Ditton kind, is placed in the pump well, nearly under the Crank, and is 48¼" diameter, by 8' 3" stroke. The Trunk, or Plunger, is 34½" diameter.

CONDENSER.

The Condenser is placed directly under the larger Cylinder, and is connected with it by the usual exhaust pipe.

AIR PUMP.

The Air Pump is worked from a pin in the Beams, inside of the pin to which the connections from the crosshead of the smaller Cylinder are attached.

CRANK-SHAFT.

The Crank-Shaft is situated at the opposite end of the Engine from the Cylinders, and carries a Fly-wheel weighing about 60,000 lbs.

CYLINDERS.

The two Cylinders are of different dimensions—the steam from the Boilers entering the small Cylinder, wherein it is cut off and expanded. At the termination of the stroke, the steam from the small cylinder escapes into the larger one, and is further expanded in it.

The effect from using the steam in this manner, instead of the ordinary method of employing but one cylinder and cutting off short to insure economy, is that, with the same initial pressure, the initial blow, or impact from the entering steam, is very much less in the case of the Compound than in that of the Single-Cylinder Engine.

The pressure throughout the stroke is likewise much more uniform, by which the power is more equally proportioned to the load, at all parts of the stroke. In the application of steam power to pumping purposes, this feature is especially desirable, as the load, or fluid, elevated is practically a dead lift, nearly uniform throughout the stroke, and is not of the elastic character as is the load for most manufacturing purposes, derived from the momentum of revolving portions of the mechanism.

A large measure of economy is claimed for the Double, over the Single-Cylinder Engine, which developes itself in practice.

DIMENSIONS OF CYLINDERS.

In the drawing presented, the Cylinders are 80" diameter by 10' stroke, and 54" diameter by 5' 6" stroke respectively. Upon further investigation, it may be desirable to modify these dimensions somewhat.

ACTION.

The steam from the Boilers first enters the small Cylinder, following the piston to about eight-tenths (8-10) of the stroke, when it is cut off and expands during the remainder of the stroke of the small piston. At the termination of the stroke, the steam in the small Cylinder escapes into the larger one, and is further expanded in it—steam from the boilers at the same time entering the opposite end of the small Cylinder. After the steam in the larger Cylinder has performed its office, it escapes into the Condenser.

INITIAL BLOW.

In a Double-Cylinder Engine of the dimensions here given, and with the steam cut off at about eight-tenths (8-10) of the stroke in the smaller Cylinder, the expansion equals five times the original volume. With steam of the initial absolute pressure of thirty-six (36) lbs. per square inch, the initial blow is represented by 132,141.

With a Single Cylinder of 80" diameter by 10' stroke, and cut off at one quarter (¼) of the stroke, the expansion equals four times the original volume; and with the same initial absolute pressure of thirty-six (36) lbs. per square inch, the initial blow is represented by 168,390; being a difference of 36,249, or 27 per cent.

DIFFERENCE OF PRESSURES.

The maximum pressure brought to bear upon the Beam Pins, Beams, &c., in the use of the Double-Cylinder Engine, is represented by 132141; and the minimum pressure by 63434, or about 48 per cent. of the maximum pressure.

The maximum pressure upon the same parts, in the use of the Single-Cylinder Engine, and with the same initial pressure, is represented by 168390; and the minimum pressure by 32673, or about 19 per cent. of the maximum pressure.

PRESSURE.

The maximum pressure in the Double-Cylinder Engine is about 78 per cent. of that in the Single Cylinder; and the minimum pressure in the Double Cylinder is about 150 per cent. of that in the Single Cylinder.

CAPABILITY.

One engine is intended to be capable of lifting 12,000,000 gallons of water into the Low Service Reservoir in twenty-four hours, through a force main, as at present proposed, 36 inches diameter and 2,323 feet long, having a vertical elevation of 225 feet.

WEIGHT OF ENGINE.

The weight of one engine will approximate 400 tons.

BOILERS.

The Boilers, of which the accompanying drawing shows the general plan and arrangement, are of the internal fire box and drop flue class; and are seven (7) feet in diameter by twenty-eight (28) feet long. The waist, or that portion back of the fire box, is cylindrical, while the fire box portion is a semi-circle on the top, oval at the bottom, with a short straight section at the sides. The whole of the fire box portion, as also the back and front connections, will be stayed to an equivalent strength with the cylindrical portion.

STEAM DOME.

On the top of the Boiler is a Steam Dome, forty-two (42) inches in diameter, and four (4) feet high, to which the steam pipe is connected. Each boiler rests upon four (4) cast iron saddles, fitted to the under side of the Boiler, and supported by masonry.

FLUES.

The products of combustion, upon leaving the Furnace, pass through the upper tier of flues to the back connection at the rear end of the Boiler, returning through the lower tier of flues to the front connection, immediately behind the fire box, where they leave the interior, and pass under the waist of the Boiler to the flue leading to the chimney; having passed nearly three times the length of the Boiler before entering the latter flue.

NUMBER OF BOILERS.

Four (4) of these Boilers are expected to do the maximum work of one Engine, viz: to deliver 12,000,000 gallons of water into the Reservoir in twenty-four hours.

In the drawing herewith presented, six boilers are shown, with provision for two others. It is calculated that these six boilers, in connection with two engines, will deliver 18,000,000 gallons of water into the Reservoir in twenty-four hours, which is supposed to be all that will be required for some years to come.

The other two boilers can be supplied whenever the necessity for them arises, without any change in the buildings or boiler foundations.

Each boiler will be supplied with a stop valve and safety valve, so that any one or more of them can be put out of use, for cleaning or repairs, without impairing the efficiency of the remainder.

The drawing of the Boilers shows the general arrangement of the flue leading to the chimney, the Boiler House, and the relation of the Boiler House to the Engine House.

These plans are not supposed to be accurate in all the details, and are only intended to give the general idea and the principal dimensions.

WEIGHT OF BOILERS.

Each Boiler will weigh about 30,000 lbs., exclusive of grate bars, safety and stop valves, &c.

WEIGHT OF ACCESSORIES.

The approximate weight of the Boiler accessories for six Boilers, including steam pipes, safety and stop valves, grate bars, floor plates in Boiler Room, and the necessary iron work for the Boiler foundations, &c., will be from 60 to 65 tons.

COST OF ENGINES AND BOILERS.

The cost of two Engines and six Boilers, erected complete and satisfactorily tested, will approximate $280,000.

Descent of the Allegheny River,

TAKEN FROM

ELLET'S REPORT ON THE MISSISSIPPI AND OHIO RIVERS.

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	Distances, Miles.	Fall, Feet.	FALL PER MILE.	
			Feet.	Inches.
From Coudersport to Olean Point,......	40	246	6	2
" Olean Point to Warren,.............	50	216	4	4
" Warren to Franklin,................	70	227	3	3
" Franklin to Pittsburgh,.............	130	261	2	
" Coudersport to Pittsburgh,.........	290	950		

Elevations of the Allegheny River at Low Water.

	Feet above Tide.
Pittsburgh,..	699
Franklin,...	960
Warren,..	1187
Chatauque Lake,..	1306
Olean Point,..	1403
Mouth of Oswaya,..	1419
Smithport,...	1480
Coudersport,..	1649