# POWDERED ANTHRACITE

AND

# GAS FUEL

# MANUFACTURERS' REPORT

SCRANTON BOARD OF TRADE

SCRANTON, PA.

# REPORT

OF THE

# Scranton Board of Trade,

## SCRANTON, PA.

1886.

---



COMMITTEE ON DIRECTORY AND REPORT, 1886.

H. A. KINGSBURY, Chairman.

A. W. DICKSON, . . . . L. N. KRAMER.

# SCRANTON BOARD OF TRADE.

ORGANIZED 1867.

---

## LIST OF OFFICERS AND COMMITTEES FOR 1886.

J. A. PRICE, President.
J. M. KEMMERER, Vice-President.
A. W. DICKSON, Treasurer.
R. W. LUCE. Secretary.
WM. CONNELL, }
WM. H. PERKINS, } Trustees.
G. A. FULLER, }

### COMMITTEE ON MANUFACTURING AND REAL ESTATE.

W. T. SMITH, Chairman.

WM. CONNELL,
THOS. H. DALE,
I. A. FINCH,
JOHN E. ALLEN,
LEWIS PUGHE,
HENRY BELIN, Jr.,
E. C. FULLER,
C. SCHROEDER,
G. L. DICKSON,
E. B. STURGES,
B. H. THROOP,
JAMES P. DICKSON.

### COMMITTTEE ON STREETS AND HIGHWAYS.

L. N. KRAMER, Chairman.

T. C. SNOVER,
LUTHER KELLER.

### COMMITTEE ON LEGISLATION AND TAXES.

A. W. DICKSON, Chairman.
GEORGE KELLER,
CYRUS F. JONES,
J. C. HIGHRITER,
F. W. MARTIN.

### COMMITTEE ON FINANCES.

J. M. KEMMERER, Chairman.

J. H. GUNSTER,
G. W. FRITZ.

### COMMITTEE ON TRANSPORTATION.

J. A. LANSING, Chairman.

I. F. MEGARGEL,
SIMON RICE.

# LIST OF MEMBERS

—— OF THE ——

# SCRANTON BOARD OF TRADE.

J. J. ALBRIGHT, Gen. Coal Agent D. & H. Canal Co., and Prest. First National Bank.
FRED J. AMSDEN, Architect.
R. W. ARCHBALD, County Judge.
JOHN E. ALLEN, Proprietor Wyoming House.
WM. H. ALLEN, of Allen, Hallack & Co., Wholesale Grocers.
H. M. BOIES, Prest. Dickson Manfg. Co., and Moosic Powder Co.
REESE G. BROOKS, Gen. Supt. L. I. & C. Co. Coal Mines.
H. BATTEN, of H. Batten & Son, Hardware.
G. J. BABCOCK, Wholesale Produce and Commission.
H. BELIN, Jr., Prest. Consumer Powder Co.
WM. BLUME, Carriage Manufacturer.
F. A. BEAMISH, Propr. *Sunday Free Press.*
M. BROWN, Dry Goods and Millinery.
JOHN BENORE, Contractor and Builder.
JOHN E. BARRETT, Editor and Proprietor *Truth.*
WM. CONNELL, Proprietor Meadow Brooks and National Mines.
H. A. COURSEN, of Coursen, Clemons & Co., Wholesale Crockery.
A. H. COLEMAN, Grocer.
F. L. CRANE, Wholesale and Retail Hats and Caps.
DAVISON CASTLES, of Castles & Innis, General Merchants.
M. STEWART CANN, City Editor *Truth.*
G. C. COURTRIGHT, Wholesale and Retail Boots and Shoes.
J. CLELAND, Proprietor Globe Warehouse, Dry Goods.
T. C. CASEY, of Casey Brothers, Wholesale Liquor.
OWEN CUSICK, Undertaker and Livery.
J. H. CAMPBELL, Attorney.
JACOB COHEN, Real Estate.
P. H. COYNE, Proprietor Coyne House.
THOMAS H. DALE, of Dale & Co., Wholesale Provisions
A. W. DICKSON, President Weston Mill Co., Flour and Feed.
JAMES P. DICKSON, Iron Ore Dealer.
GEO. L. DICKSON, Vice-President First National Bank.
H. C. DOUD, Agent Travelers Insurance Co.
J. EDGAR DEAN, Physician.
J. M. EVERHART, Proprietor Brass Works.
E. C. FULLER, of L. S. & E. C. Fuller, Druggists.
G. A. FULLER, Proprietor Fuller Clothing House.

JOHN L. HULL, Slate and Agricultural Implements.
A. E. HUNT, of Hunt & Connell, Hardware.
SAMUEL HINES, General Coal Agent Erie Co.
J. J. HOWLEY, Plumber.
J. S. HORTON, Printer.
D. M. JONES, Real Estate Broker.
JOHN JERMYN, Gen. Manager Susq. & Western Co., and Coal Operator.
C. F. JONES, of Jones Brothers, Wholesale Coffee and Tea.
HON. LEWIS JONES, Counselor-at-Law.
GEO. A. JESSUP, Cashier City Bank.
GEO. W. JENKINS, of Jenkins & Co., Druggists.
WM. KELLY, Wholesale Liquor.
L. N. KRAMER. Clothing and Gents' Furnishing Goods.
S. G. KERR, of S. G. Kerr & Co., Carpets.
GEO. KELLER, Hardware.
JACOB KEIPER, Contractor and Builder.
LUTHER KELLER, Lime and Cement.
JOHN KNITTLE, Contractor and Builder.
J. M. KEMMERER, of Brittenbender & Co., Wagon Supplies.
VICTOR KOCH, Proprietor Scranton House.
WM. D. KENNEDY, of P. Carter & Co., Edged Tools.
H. A. KINGSBURRY, Storekeeper, L. I. & Co.
T. J. KELLY, of T. J. Kelly & Co., Wholesale Grocers.
H. W. KINBACK, Proprietor St. Cloud Hotel.
F. E. LOOMIS, Attorney and Real Estate.
MAURICE LEVY, of Samter Bros. & Co., Clothiers.
J. A. LINEN, Cashier First National Bank.
J. A. LANSING, Secretary Scranton Stove Works.
JOSEPH LEVY, of Levy Bros. & Co., Wholesale Dry Goods.
THOMAS LUCAS, of Lucas & Co., Dry Goods.
B. E. LEONARD, of Leonard Bros., Hardware.
R. M. LINDSAY, Proprietor Boston Store, Dry Goods.
JACOB LOTZ, Printer.
LEVI LINDLEY, of Lindley & Co., Fruits.
J. J. LAWLER, Plumber Expert and Hardware.
REV. S. C. LOGAN, D.D., Pastor First Presbyterian Church.
R. W. LUCE, of R. W. Luce & Son, Fire Insurance.
P. J. McHALE, Meat Market.
B. G. MORGAN, of Morgan & Co., Druggists.
R. J. MATTHEWS, of Matthews Bros., Wholsale Druggists and Oils.
I. F. MEGARGEL, of Megargel & Connell, Wholesale Grocers and Jobbers.
C. P. MATTHEWS, Wholesale Flour.
F. W. MARTIN, of Martin & Delaney, Clothing.
EDWARD MERRIFIELD, Attorney.
WM. MATTHEWS, President People's Street Railway.
A. P. MALONEY, of Maloney & Watkins, Wholesale Oils.
JAMES MATTER, Blacksmith.
M. D. MAY. Proprietor May House.
H. D. MOSES, Merchant Tailor.
A. C. NETTLETON, Boots and Shoes.

M. NORTON, Wholesale Paper Hanger and Books.
A. J. NORRMAN, Fire Insurance.
S. M. NASH, Proprietor Nash Auction House.
RICHARD O'BRIEN, Dist. Supt. Western Union Telegraph.
HON. LEWIS PUGHE, of Monies & Pughe, Bakers.
C. E. PRYOR, of Pryor & Thompson, Books and Musical Instruments.
WM. H. PERKINS, Treasurer Dickson Manufacturing Co.
F. P. PRICE, Groceries.
JOHN T. PORTER, Wholesale Fruits.
J. A. PRICE, President Scranton Stove Works.
J. H. PHELPS, Druggist and Proprietor of Phelps' Rheumatic Elixir.
H. S. PIERCE, President Pierce Coal Co., Lackawanna Coal Co., and Carbondale National Bank.
W. H. RICHMOND, President Richmond Coal Co.
EZRA H. RIPPLE, Mayor.
SIMON RICE, of S. Rice & Brother, Wholesale Grocers.
AUGUST ROBINSON, Brewer.
JOHN E. ROCHE, Money Order Clerk, Post Office.
CHARLES SCHLAGER, Wholesale Produce and Commission.
T. C. SNOVER, of Clark & Snover, Tobacco Manufacturers.
THOS. G. SMITH, of Smith & Clearwater, Candy Manufacturers.
J. H. STEELE, of Beadel & Steele, Grocers.
JOHN SIMPSON, Globe Warehouse, Dry Goods.
E. B. STURGES, Attorney.
W. T. SMITH, Proprietor Mt. Pleasant Colliery.
HENRY SNYDER, Carpenter and Builder.
LEOPOLD SCHIMPFF, Brewer.
Rev. DAVID SPENCER, D. D., Pastor First Baptist Church.
C. D. SIMPSON, of Simpson & Walkins, Diamond Drills.
A. B. STEVENS, Bridge Coal Co.
FREDERICK SHROEDER, Bottler.
CONRAD SCHROEDER, Contractor and Builder.
M. E. STOWERS, of Stowers P. P. & P. Co.
JOHN SNAITH, Contractor and Builder.
CALVIN SEYBOLT, Proprietor of Seybolt Mill, Flour and Feed.
N. H. SHAFER, Fire Insurance.
C. R. SMITH, Fire Insurance.
Hon. J. A. SCRANTON, Proprietor *Republican*, and M. C.
COL. IRA TRIPP, Farmer.
Dr. B. H. THROOP, President City Bank.
WM. H. TAYLOR, of Scranton Supply Co., Hardware.
A. H. VANDLING, General Agent Delaware & Hudson Canal Co.
THOMAS H. WATTS, Wholesale Flour and Provisions.
JAMES WOOLSY, Contractor and Builder.
LOW J. WILLIAMS, of Williams & McAnully, Carpets.
C. F. WHITTEMORE, of Powell & Co., Musical Instruments.
FREDERICK WAGNER, Printer.
W. W. WATSON, of Watson & Hawley, Attorneys.
HON. L. A. WATERS, State Senator and Attorney.
J. D. WILLIAMS, of J. D. Williams & Brother, Candy Manufacturers.
EVERETT WARREN, of Willard & Warren, Attorneys.

# REPORT.

## LOCATION OF THE CITY OF SCRANTON.

The northern anthracite coal field comprises 198 square miles, or 126,720 acres. The city of Scranton is the natural and the recognized center of this important district. Its future is guaranteed by this immense deposit, aggregating nearly 50 feet in thickness through all the surrounding territory, while the contiguity of this valuable mineral to the great markets East and West, North and South, renders all prospective calculation almost a certainty.

## THE ANTHRACITE COAL FIELD.

Eastern Pennsylvania contains all the pure anthracite coal of the world, in all 470 square miles of territory, located in Lackawanna, Luzerne, Carbon, Schuylkill, Northumberland, Dauphin and Columbia counties. The progressive development of anthracite mining has reached about one-third of the whole coal out-put of the United States.

The following tables are presented, exhibiting the annual production from 1820 to 1885, and that belonging to the Lackawanna district. These valuable statistics are taken from the most admirable compilations of Mr. F. E. Saward, of New York, and Mr. I. H. Jones, of Philadelphia. They are interesting tables for preservation and instruction, as they exhibit the steady growth of the whole country in the last half century. The use of anthracite has become a reliable gauge of the permanent progress of Western civilization:

TABLE OF TOTAL OUT-PUT.

| Year. | Tons. | Year. | Tons. |
|---|---|---|---|
| 1820, | 365 | 1853, | 5,195,151 |
| 1821, | 1,073 | 1854, | 6,002,334 |
| 1822, | 3,720 | 1855, | 5,608,567 |
| 1823, | 6,951 | 1856, | 6,927,550 |
| 1824, | 11,108 | 1857, | 6,644,941 |
| 1825, | 34,893 | 1858, | 6,839,369 |
| 1826, | 48,047 | 1859, | 7,808,255 |
| 1827, | 63,434 | 1860, | 8,513,123 |
| 1828, | 77,516 | 1861, | 7,954,264 |
| 1829, | 112,083 | 1862, | 7,869,407 |
| 1830, | 174,734 | 1863, | 9,566,006 |
| 1831, | 176,820 | 1864, | 10,177,475 |
| 1832, | 363,271 | 1865, | 9,652,391 |
| 1833, | 487,749 | 1866, | 12,703,882 |
| 1834, | 376,636 | 1867, | 12,988,725 |
| 1835, | 560,758 | 1868, | 13,801,465 |
| 1836, | 684,117 | 1869, | 13,866,180 |
| 1837, | 869,441 | 1870, | 16,182,191 |
| 1838, | 738,697 | 1871, | 15,699,721 |
| 1839, | 818,402 | 1872, | 19,669,778 |
| 1840, | 864,379 | 1873, | 21,227,952 |
| 1841, | 959,773 | 1874, | 20,145,121 |
| 1842, | 1,108,412 | 1875, | 19,712,472 |
| 1843, | 1,263,598 | 1876, | 18,501,011 |
| 1844, | 1,630,850 | 1877, | 20,828,179 |
| 1845, | 2,013,013 | 1878, | 17,605,262 |
| 1846, | 2,344,005 | 1879, | 26,142,689 |
| 1847, | 2,882,309 | 1880, | 23,437,242 |
| 1848, | 3,089,238 | 1881, | 28,500,016 |
| 1849, | 3,242,966 | 1882, | 29,120,096 |
| 1850, | 3,358,899 | 1883, | 31,793,027 |
| 1851, | 4,448,916 | 1884, | 30,718,293 |
| 1852, | 4,993,471 | 1885, | 31,623,529 |

The local companies of the Lackawanna District began shipping coal with the Delaware & Hudson Canal Company in 1829, the Pennsylvania Coal Company in 1850, the Delaware, Lackawanna & Western Railroad Company in 1854, and the Erie Railway Company in 1871. These great carrying companies exhibit the following enormous tonnage from the beginning to the present time:

TABLE OF COAL CARRIED BY LOCAL COMPANIES.

| | D. & H. C. Co | D., L.& W. Co | Pa. Coal Co. | Erie R'y Co. |
|---|---|---|---|---|
| 1829, | 7,000 | ... | ... | ... |
| 1830 to '39, | 846,333 | ... | ... | ... |
| 1840 to '49, | 2,897,981 | ... | ... | ... |
| 1850 to '59, | 4,838,855 | 2,629,364 | 4,834,723 | ... |
| 1860 to '69, | 10,098,691 | 13,343,126 | 7,249,820 | ... |
| 1870, | 2,318,073 | 2,117,612 | 1,136,010 | ... |
| 1871, | 1,955,737 | 1,730,242 | 848,635 | 55,596 |
| 1872, | 2,882,479 | 2,520,330 | 1,266,762 | 83,288 |
| 1873, | 2,732,267 | 2,952,941 | 1,297,604 | 36,728 |
| 1874, | 2,290,791 | 2,353,539 | 1,396,326 | 197,562 |
| 1875, | 2,843,229 | 2,833,670 | 1,426,377 | 303,039 |
| 1876, | 1,809,190 | 1,998,654 | 1,143,922 | 230,709 |
| 1877, | 1,787,470 | 2,089,523 | 1,118,011 | 175,095 |
| 1878, | 2,046,235 | 2,180,673 | 957,032 | 278,132 |
| 1879, | 3,014,117 | 3,867,405 | 1,427,150 | 477,783 |
| 1880, | 2,712,910 | 3,550,348 | 1,123,585 | 411,094 |
| 1881, | 3,211,496 | 4,338,969 | 1,427,747 | 465,230 |
| 1882, | 3,297,826 | 4,595,518 | 1,438,820 | 330,510 |
| 1883, | 3,512,973 | 5,011,407 | 1,481,682 | 382,194 |
| 1884, | 3,362,680 | 5,204,362 | 1,397,946 | 484,844 |
| 1885, | 3,301,873 | 4,987,834 | 1,500,685 | 651,226 |

Comparing this table with the foregoing, it will be seen that the Lackawanna District supplies one-third of the entire anthracite tonnage. The increase of consumption and demand is even and constant, assuring in all reasonableness the accuracy of calculation, and warranting confidence in the future.

## THE FUEL QUESTION.

Fuel is the great element of the age. It is the basis of our civilization. It is the important factor in domestic life, as 65 per cent of all the anthracite tonnage is consumed for domestic purposes, owing to its cleanliness, its solidity, and its heating quality. Besides this important element, the great question of all the industries, power and wealth, is fuel. The swift-running streams, the waterfalls, tidal-waves and air-currents, once supplied nearly all the artificial power to man, the balance being furnished by animals and men. Within a century the world has been revolutionized, and 50 years have witnessed an astonishing increase.

Referring to the United States census of 1870 and 1880, for purpose of illustration and comparison, we find that in 1870 there were, total, 2,346,142 horse-power, consisting of both steam and water-power, being divided into 1,130,431 horse-power, or 48.18 per cent water, and 1,215,711 horse-power, or, 51.82 per cent of steam-power ; and, in 1880, out of the total horse-power, 3,410,337, 35.39 per cent, or, 1,225,379 horse-power, was water, and 64.07 per cent, or, 2,185,458 horse-power, was steam-power. It sufficiently illustrates the rapid increase and the coming reliance upon the combustion of the self-contained elements in the earth rather than natural or elemental forces.

The processes of combustion have been heretofore, and are yet, to a great extent, wasteful in the extreme ; and, notwithstanding a definite knowledge of the fact, they have remained comparatively crude and inefficient,—from 75 to 90 per cent is absolutely lost in the general utilization of coals of any kind. Investigation and invention have gone hand in hand to arrest this loss and waste. A partial saving has been effected in securing the best service of mechanical grates, inclosed fire-chambers, and revertible flues. Material progress has been made in this art otherwise, and which predicts entire revolution. The processes will be briefly alluded to in the following pages. The first important step has been in the direction of a mechanical preparation of the fuel, reducing it to a dust form, so fine that it will float in the air like smoke clouds; or, about 125,000,000 particles to the cubic inch.

---

## PULVERIZED COAL OR DUST FUEL.

An adequate knowledge of the fuel question can only be obtained by a systematic pursuit of the various results already obtained. Beginning, then, with anthracite reduced to impalpable powder, we find in a process techincally known as the "Whelpley and Storer" the first intimation of success.

Mr. H. M. Chance, connected with the Second Geological Survey of Pennsylvania in 1883, says:

"The United States Government has solved the problem of utilizing coal waste, or culm, at the National Armory, Springfield, Mass., and is effecting an economy of 60 per cent over old methods of heating by the use of pulverized anthracite. The process for the complete combustion and economy of fuel in heating and the generating of steam commonly known as the Whelpley & Storer process, and which has been fully described in many scientific journals, makes an effective saving to manufacturers of not less than one-half the total expenses of steam generation.

"A pound of coal will give an equal amount of *heat*, whether burned quickly or slowly, but the *temperature* of the flame and gases depends entirely upon the manner of combustion. It is a fact, familiar to all, that a block of wood may consume slowly, and but slightly increase the temperature of the fire-place; while if the block be made into shavings, the burning will be extremely rapid, with corresponding increase of temperature, the amount of heat in each instance being the same, but in the one being generated and made effective in much less time than in the other.

"This familiar illustration has its perfect application in indicating some of the advantages of pulverized over lump coal for the generation of steam. The success of the matter depends upon:

"*First.* Simple and efficient machinery to reduce the coal to dust, at very small cost.

"*Second.* Reduction of the coal to floated dust.

"*Third.* Automatic supply of coal and air, each capable of being regulated at will.

"*Fourth.* The reduction of the coal and the simultaneous feeding of it with air into the fire-box by the same machine.

"*Fifth.* The intimate mixture of the fine particles of coal-dust with air, so that each particle shall be surrounded as it enters the fire-box by air sufficient for its combustion.

"It will be evident to every one that the absence of either one of these conditions would seriously affect the value of the process, and render its adoption doubtful, and at the same time it must be as apparent that, with these conditions guaranteed, as they are now, the process must rapidly grow into general use.

"ECONOMIES."

"1. Anthracite and bituminous waste coals, culm, and screenings, are the best for use by this process; and the first economy lies in their cheapness, as compared with lump and grate fuel. This saving in first cost approximates two dollars to three dollars per ton.

"2. The rapid and complete combustion of the comminuted coal by this process, by which one-third more water is evaporated in a given time; in other words, two pounds of comminuted coal will do the work of four pounds of lump or grate coal burned in the usual way. No smoke, sparks, nor cinders arise from burning comminuted coal; the combustion is thorough and complete.

"3. By the use of comminuted coal, it obviates the necessity of expensive brick smoke-stacks, which almost every one builds for the creation of good draught under their boilers, or for their heating furnaces and for carrying off smoke. A cheap and simple sheet-iron chimney is sufficient when the comminuted fuel is used.

" 4. With the application of comminuted coal for generating steam, etc., no grate-bars are required by this process of firing. The burning out and renewal of grate-bars is a constant source of expense, annoyance and delays to manufacturers.

" 5. The feeding of the comminuted coal fuel to boilers being regular through a feed-pipe (no opening of doors whatever, causing the steam to run down, as is the customary method of firing now), it keeps the pressure of steam always at a uniform pressure in the boilers, as may be desired.

" 6. The comminuted coal being fed automatically by the apparatus, it lessens the labor materially, and one man can readily attend to the feeding of ten boilers by this process, and it is very much less painful than firing is now done by the old method.

" 7. The saving by this process of transporting fuel for generating steam is a very important item to ocean and lake steamers; by the application and use of comminuted coal fuel, instead of using lump fuel, the saving of over fifty per cent in the weight of coal may be utilized in the carrying capacity for transporting freight, with profit to owners, as an offset to the extra coal now carried to burn under the boilers, besides an approximate saving of three dollars per ton in the first cost, on the coal suitable for comminuting, for actual use in generating the steam."

The following testimony from the National Armory, Springfield, Mass., speaks for itself:

"NATIONAL ARMORY, WATER SHOP,
" SPRINGFIELD, Mass., October 16, 1884.

" TO ALL WHOM IT MAY CONCERN:

" Agreeably to instructions received from Lieut.-Colonel J. G. Benton, commanding, I made a thorough investigation of the process and application of pulverized coal to furnaces for heating purposes, as applied and invented by Messrs. Whelpley & Storer, and after such investigation their process was, at my recommendation, introduced in the water shops at this armory.

" The process was applied to the principal furnaces for heating, welding, rolling iron and steel barrel moulds or tubes for carbine barrels, musket barrels, etc., with the very best of results.

"The machine and furnace are in daily use and have been running constantly for five years, producing good work, and saving over fifty per cent (50 per cent) of the fuel we consumed before this process was applied to our furnaces. *There is no lack of heat.* The feeding of the coal to the furnace, reduced to its flour or comminuted condition by the apparatus of Messrs. Whelpley & Storer, is very regular and uniform. It ignites instantly upon its entrance to the furnace like gas, and produces a clear, soft and mellow heat, and it can be regulated so as to produce either a low, moderate temperature of heat or increased to an intense blow-pipe flame of a very high degree, for welding or melting purposes, the smelting of ores, etc.

"The machine is about 45 minutes in heating the furnace to a welding heat. The running parts are not complicated, and do not easily get out of order. The repairs on same do no exceed fifteen dollars annually.

"The machine and process are, in my judgement, equally applicable to the generating of steam under boilers with great economy, and as the burning of the coal by this process makes a perfect combustion, free from smoke and cinders, it is, in my judgement, especially applicable for burning on locomotives and ocean steamers with comfort to travelers, and the nature of the blow-pipe flame that can be produced by the machine makes it peculiarly adapted for permeating and burning the garbage, etc., of cities for sanitary purposes, or producing fertilizer therefrom.

"We use waste coal or screenings exclusively, either anthracite or bituminous (the finer it is the better). The apparatus of Whelpley & Storer reduces the coal to a comminuted or flour state. Meanwhile, during the process of reduction, the fuel is mingled properly with air, and it is then conveyed or propelled automatically by the machine through a feed pipe to the furnace. The pulverulent coal and air being thus mixed, instantly ignites upon its entrance to the furnace, *like gas.* The apparatus is self-feeding direct to the furnace. The machine is of the simplest description and easily adjusted. We never have had any trouble whatever in running it. The apparatus is almost indispensable for the work in our rolling-mill department.

"C. E. BAILEY,

"*Foreman National Armory Water Shops, Springfield, Mass.*"

Also: The report of Charles E. Emery, Esq., of New York, states that "the process consists substantially in blowing pulverized bituminous and anthracite coal over a small fire. The pulverized fuel ignites in the furnace like gas, and burns with an intense heat, the flames extending the whole length of the boiler. The pulverizing machinery is of the simplest description, and works admirably. It is provided with an automatic feed, which can be adjusted to supply regularly any quantity of fuel desired. The advantages of the Whelpley & Storer process are, first, the regularity of performance produced by the automatic feeding of a large portion of fuel; and, second, the saving due to cheaper fuel."

Professor T. S. Hunt, most eminent authority before the American Association for the Advancement of Science, says:

"The effects obtained by the combustion of charcoal or other fuel, pulverized and borne in a current of hot air, are very surprising. The finely-divided combustible, being kindled by the flame drawn from the fire-boxes, burns in the descending current with great energy, and, from the comparatively large surface exposed to the action of the air, generates a great amount of heat, and, with an excess of fuel, an intense light. The great fiery blast, nearly filling the tower, can at pleasure be made oxidizing or reducing in its action, by regulating the supplies of fuel and of air. I have seen it, at twelve feet from the top, so potent as to heat rapidly to whiteness two feet of a wrought-iron bar an inch in diameter, and cause it, though supported at both ends, to bend like wax beneath its own weight in thirty seconds after it was placed in the blast. *The powerful heating effects which may be obtained by the use of pulverized fuel are readily understood when we consider that a cubic inch of coal, reduced to particles one five-hundredths of an inch in diameter, will present to the action of the atmospheric oxygen a surface equal to not less than twenty-one square feet. This application of fuel promises to have important results for heating reverberatory, muffle, and glass furnaces, for the working of iron, and even for the generation of steam. Solid combustibles are by this method practically volatilized, and broken and refuse fuel is made available.*"

The remarks of Prof. Hunt exposes the principal of combustion in a pulverized as against a mass condition of the fuel. The oxygen having a great affinity for the carbon, and being able to get at it only upon the surface, it will be readily apparent to the most unobserving of fuel users, that both effectiveness and economy have been secured, while the labor, and wear and tear are greatly diminished. The possibilities of the pulverized system are great, as even higher temperatures can be maintained, combustion is nearly complete, and the saving is unquestioned. The following selection will confirm what is intended to be conveyed :

BY LIEUT. C. E. DUTTON, U. S. ORDNANCE CORPS.

*Extract from the Journal of the Franklin Institute.*

" Having been invited by Messrs Whelpley & Storer, to visit their establishment, and examine their new method of applying fuel to metallurgical and other purposes, I have been so profoundly impressed with the results of the experiments witnessed, that I take the liberty to lay before the society a discussion of the subject. *Their method consists in pulverizing the coal to an extreme degree of fineness, and blowing it into the combustion chamber, where it is ignited and burned in the air which floats it.*

"To most practical minds this will certainly appear to be new, and will at first receive the hasty judgment passed upon new ideas. Yet nothing can be more certain than that the principles upon which are based the claims of superior economy and efficiency in this mode of utilizing fuel are entirely sound, and are demonstrable by well-known laws of thermodynamics, and by practical considerations familiar to every educated engineer.

"The feed of fuel will, of course, be determined primarily by the requirements of the furnace, and the minimum quantity which will effect the desired temperature will, in each case, be determined experimentally. If the fuel be diminished, an insufficient heat will be obtained; and if it be increased, the loss will be threefold: (1) the surplus fuel will burn to waste; (2) the effort of the machine to clear itself from an overwhelming supply will absorb more power; and (3) drive out the coal before it is sufficiently pulverized. In brief, the result being more power and more fuel consumed, and less heat developed.

"The amount of air admitted should be sufficient to float readily the pulverulent coal, but not more. . . . The air enters the pulverizer through the same inlet and along with the coal. The aperture is adjustable, as is also the feeding apparatus, thus affording perfect and instantaneous control over the supply of both. The advantage of being able to stop a fire completely in an instant, and renew it in full force as quickly, and also to regulate it at pleasure, by the mere motion of a valve or hand lever, is so great as to need the merest mention in order to be appreciated."

For the purposes heretofore indicated, anthracite coal has the largest degrees of utility; and the vast mountains of waste, to which reference will be made hereafter, are as good as the best of coal from the mine.

## GAS FUEL THE FUTURE FUEL.

No one will dispute the desirability of a gaseous over a solid fuel. Natural gas has given the impetus to thought upon this most important subject; and it may be set down as a substantial fact that the days of solid fuels for many purposes are numbered, and that we shall soon usher in the new candidate for public favor,and transform all the solid fuels into gaseous before using. In this respect, the anthracite coal, combining, as it does, the largest per cent of carbon—from 80 to 94 per cent,—will lead all in the contest for supremacy, and to which in cheapness and effectiveness, natural gas will bear no favorable comparison.

The following table of utilization of fuel in mass, and as a gas is significant, and leaves no room for argument :

| | ONE LB. COAL. | GAS FROM ONE LB. COAL. |
|---|---|---|
| | Crucible Furnace. | Crucible Furnace. |
| Per cent of heat utilized, | $3\frac{1}{2}$ | 90 |
| | Large Blast Furnace. | Large Blast Furnace. |
| " " | 36 | 90 |
| | Domestic Use. | Domestic Use. |
| " " | 10 | 90 |
| | Crucible Furnace. | Crucible Furnace. |
| Available heat, | 455 | 7246 |
| | Large Blast Furnace. | Large Blast Furnace. |
| " | 4680 | 7246 |
| | Domestic Use. | Domestic Use. |
| " | 1300 | 7246 |

Natural gas has forced the issue and it will surely fail of competition in the end. Natural gas is a limited or sectional product, fitful, and of doubtful dependence. It is not found everywhere, and, when found, it begins to show exhaustion from the start, with some rare exceptions. Its control is expensive, and it cannot be carried successfully a distance greater than 30 miles. It will ever be subject to combination and monopoly, as oil has been ; natural competition cannot be maintained as with coals ; and the manufacturers who pin their reliance to these doubtful possibilities are certain to be deceived and discomfited eventually.

Dr. Walther Hempel, a distinguished European chemist, of Dresden, Germany, asserts, December 31, 1885, that:

" While there are difficulties which remain to be overcome, present results show clearly that in the future all heating processes, also cooking, will be done only by gas."

" Many disadvantages will thus be obviated which are connected with the use of coal. All processes, therefore, which improve the making of gas by introducing new principles into its manufacture are so many steps forward."

German, French, English and American scientists and inventors are at work upon these grave questions. Contributary testimony may be multiplied indefinitely. Gas is the coming fuel, as it is found to possess the first three principles of combustion, such as cannot be attained in any present or past use of solid material.

The incandescence of coals is maintained in the ordinary furnace, and the only effective combustion obtained is that of the gases after they leave the solid mass. The furnace is, therefore, a crude, costly, and inadequate gas producer. Hence, the construction of the most perfect system for the conversion of carbon into carbonic oxide, and water into hydrogen and oxygen, instead the rough and uncouth furnace, is the desirable as well as profitable end. This has been largely accomplished, and the only apparent remaining task is the introduction and adoption of the improvements generally.

Solid fuel as now consumed, is accompanied by a wasteful extravagance—from 70 to 90 per cent of the products of combustion pass away as a loss. This is the testimony of Siemens, Rankin, Galloway, Grouven, and others, and cannot be doubted. Gas fuel reduces this waste to a minimum, and it is possible to transform coal in togas with little appreciable loss of substance. There is no remaining opportunity to doubt that the economies as well as the highest results lie in the use of gaseous fuel; and, as anthracite coal and its attendant waste are capable of yielding the largest possible percentage of gaseous product, it is an indisputable fact that the anthracite coal district possesses, beyond all measure, the broadest and best features for the reliance of manufactures and industries.

Gas will centainly supersede solid fuels in the production and development of steam, and will, doubtless, in turn, do away with the dangerous steam boiler itself, making a short cut directly from the producer to the gas engine. The steam engine is nearly as wasteful as the modern steam boiler, and gas will practically eliminate this waste, or will reduce it from ten to one, all things considered. It is, then, definately established that to burn our solid fuels as we do is not less than prodigal squandering of our inheritance.

REPORT OF THE JUDGES OF THE NOVELTIES EXHIBITION, PHILADELPHIA, UPON THE SUBJECT OF GASEOUS FUEL.

"On the general question of the desirability of gaseous fuel, there can be but one opinion. It dispenses with the trouble and annoyance of hauling and carrying coal, and with the removal of dirt and ashes; it is at all times under perfect control; when not wanted it can be instantly extinguished and can be instantly made to give its maximum effect, so that, other things being equal, gaseous fuel possesses incontestable advantages over solid fuel.

"Respecting the availability of water gas for this purpose on the score of economy, the Lowe Manufacturing Company claim to produce from a ton of coal 80,000 cubic feet of water gas, at a cost of less than ten cents per 1,000. At these figures twenty-eight pounds of anthracite coal would yield 1,000 cubic feet."

Professor T. S. C. Lowe, of the Lowe Company, summarizes his observation and calculation as follows:

"In large works and when large quantities of gas are being continuously supplied this product can be delivered through pipes to consumers as cheaply as a ton of coal can be delivered by cart and horse and put into the cellar.

"The advantages of the gas over the coal would enable the consumer to pay an average of forty cents per 1,000 cubic feet for the gas which would then be to them as cheap as other fuels. At this price it would be equal to selling coal at $32 per ton, and at thirty cents per 1,000, $24 per ton; surely margin of profit enough to pay satisfactory dividends on all the investments necessary to supply any good sized town or city. One thousand cubic feet of gas per day to each ten inhabitants, for manufacturing, domestic heating, cooking and lighting is a low estimate; nevertheless at this rate a city of 50,000 people would consume 5,000,000 cubic feet daily, which, at forty cents per 1,000 would be $2,000 per day gross income, to produce which would require sixty-three tons of coal and the labor of about ten (10) men, besides book-keepers, collectors and officers, the expense of which is easily figured."

The time may come when the coal of the anthracite field will be converted into gas in the mine, which is by no means an unwarranted speculation, and conducted by a pipeage system, as natural gas is. It will readily be seen that within the locality indicated the permanent resources for power purposes are practically inexhaustible, beyond a controlling monopoly. The anthracite coal field is nowhere and in no manner approached in its possibility of yielding facilities for manufacturing.

## WATER-GAS FUEL.

The discovery of practical processes for the conversion of water into hydrogen and oxygen was the first great forward movement in gaseous fuel, which is duly and practically supplemented by what is known as producer gas, which latter will be subsequently treated. These two separately and in combination, form the state of the art to-day. Mechanical devices are being perfected, and, unquestionably, the safe producer will take the place of the unsafe boiler in the development of power, and with little or no delay.

In reference to the generation of water gas, Prof. T. S. C. Lowe, an undoubted authority, claims that from 50,000 to 100,000 cubic feet can be produced from one ton of coal, according to the effectiveness of the apparatus; and that 80,000 feet is probably a fair average calculation per ton of coal consumed. This, with coal at market rates, and with a liberal allowance for plant and compensation for labor, would make this gas cost about nine cents per 1,000 feet. This cost may yet be reduced in the use of anthracite waste.

Professor Lowe was awarded the "Grand Medal of Honor for his substantial improvements in the manufacture of water gas as a fuel for domestic and industrial purposes," by the Board of Judges of the Franklin Institute, Philadelphia, in May, 1886, and is without exception, perhaps, a standard authority upon the subject of water gas.

Referring again to the report of the judges at the Novelties Exhibition of 1885, at Philadelphia, and remembering the fact that these gentlemen are men of practical life, fortified with all the resources of science and skilled in the advanced appliances of the day, their utterance must be accorded the weight of authority. They say:

"Water gas made by the interaction of steam and carbon at a high temperature, and composed essentially of hydrogen and carbonic oxide, has been known and employed for many years. It is only, however, of late years that the difficulties in the way of its successful commercial introduction have been practically overcome.

"Generally, the improvements that have brought about this result consists of the adoption of methods whereby the waste of heat in the various steps of the manufacture is reduced to a minimum.

"The principal portion of this waste was, formerly, the large consumption of coal required for heating the contents of the generator to the proper temperature to effect the decomposition of the steam required for the production of the gas, and the heat carried off by the water gas after its formation.

"These elements of waste have been largely reduced by the adoption of devices, whereby the products of incomplete combustion in the generator are regenerated, and caused to impart the heat derived from their subsequent combustion to such heat-storing materials, as fire-brick, etc., suitably placed in a regenerative chamber, or super-heater, forming the upper portion of the generator, or connected with it, and through which the steam is caused to pass on its way to the generator.

"Further, by using other portions of the waste heat, to heat the air used for blowing up the charge of coal in the generator, and to generate the steam required in the process. By these and other improvements in the construction of the apparatus employed, and in the details of the operation, the quality and quantity of water gas produced from a ton of coal have been respectively considerably improved and increased, and the cost of its production so notably reduced, that the problem of introducing it as a fuel for domestic and industrial purposes can be no longer considered as unsolved."

The specific gravity of the feul water-gas was determined by Dr. Ward to be ·552 (air = 1) at a temperature of 62° F. 1,000 cubic feet would, therefore, weigh 42.01 pounds. The theoretical yield of 100 pounds of pure anthracite is stated to be 228.22 pounds of pure gaseous products—the figures claimed would be 66⅔ per cent of the theoretical yield. This would leave 33⅓ per cent to provide for the consumption of coal for heating the generator for the production of steam, and for impurities of the coal.

The process of generating water-gas may be briefly described as follows: An ordinary furnace is charged with fuel and brought up to a high temperature by draft or blast, giving off a highly-heated quantity of carbonic acid, hydrogen, and carbonic oxide gas, which is discharged into a chamber or regenerator, filled with a checker work of fire brick or other refractory material. A large amount of heat is absorbed, and the combustible gases are still further consumed, until the regenerator has attained a high temperature. When the air-blast is cut off, the combustion of the fuel chamber practically ceases, and a jet of steam is turned into the regenerator, and sometimes into the fuel chamber beyond it. The steam, in passing among the highly-heated material, or through the incandescent fuel of the furnace, and to the regenerator, is decomposed into hydrogen and oxgyen, the elements of water consisting of two volumes of the former to one of the latter. The readiness with which oxygen combines with carbon introduces into the elements a certain amount of carbon, effecting the actual result of the combined gas, composed of hydrogen and carbonic oxide, the two most effective heat-producing elements in nature, except electricity. Were it not for the addition of the carbon, the hydrogen and the oxygen, that have become dissociated at a temperature of 1,000° F. and upwards, would re-unite chemically and form water as soon as the gaseous product was lowered to the proper temperature.

The result of this process, then, gives about two equivalents of hydrogen and two of carbonic oxide. The energy required to produce the decomposition of the water is considerable, and is a loss. As soon as the original energy is spent the furnace must be again fired by the draft or blast, until the incandescence of the fire and the stored heat of the refractory brick chamber are restored ; then the process is repeated. By the perfection of devices, and the introduction of additional furnaces in which fuel in a state of incandescence is maintained, the process has been exhibiting increased economies and larger possibilities.

In general, the following analysis, made by Dr. Gideon E. Moore, of New York, may be taken as a sample of a non-luminous water gas—a gas that is efficient for heating, cooking, and all industrial purposes:

| | |
|---|---|
| Nitrogen, | 4.69 |
| Carbonic acid, | 3.47 |
| Oxygen, | 0.00 |
| Heavy hydro carbons, | 0.00 |
| Carbonic oxide, | 36.80 |
| Marsh gas, | 2.16 |
| Hydrogen, | 52.88 |
| | 100.00 |

Were the heavy hydro carbons and the marsh gas present in any considerable quantities, the gas would have illuminating and be less effective in heating properties; or, it would have kindred qualities to those of the so highly-lauded product of nature—natural gas. For all industrial purposes water gas excels the natural by many degrees. Anthracite coal and Anthracite waste will produce a non-luminous gas of this kind, of greater heating power and at less cost than any other coals, oils, or material, because of the greater presence of carbon. The intense heat of the carbon, and its capability of incandescense, account for this superiority.

## PRODUCER-GAS FUEL.

The history of Producer-gas, like that of Water-gas, extends back many years. Also, like steam, the substantial fact being known, it has taken years for mankind to adopt, and, by suitable devices, render effective the product. We have passed the purely experimental condition, and have fully arrived at a period when it is simply a question of introduction and distribution of plant.

The manufacture of Producer-gas may be fairly stated to begin with the Siemens process, dating back as early as 1846, and may be said to consist of the preservation of the combustible gas—carbonic oxide—and the storing of the waste heat of the carbonic acid gas for the purpose of utilization by means of regenerators. The introduction of the steam blast by means of which hydrogen gas is added to the product is of later origin.

As has been previously stated, every process of fuel-using in the ordinary way, whether it be in stoves, heating-furnaces, under-boilers, or what-not, involves the conversion of the fuel into its component gases first, after which the heat of combustion is applicable to the boiling of the pot, the generation of steam, or the melting of metal. In this sense, every fire-place is a gas-producer. Hence, it was reasonably concluded that the more perfect the furnace, or the fire, or gas-producing apparatus, the less must be the loss.

This first step is the key to the situation, and is destined to give us a measure of utility without loss of the fuel, hitherto not conceived. This method pertains more particularly to the conversion of the soft coals, which are heavily charged with the hydro-carbons. In the case of anthracite, with its more dense carbon and its greater properties, this system is not as satisfactory; yet, it has already indicated the direction in which experiment and investigation should properly be pressed.

The next in line was the Ponsard system, of Paris. M. Ponsard, explaining his apparatus for generating gaseous fuel, says: "It is the object of my invention *to increase the production of carbonic oxide* from a given quantity of fuel." Carbonic oxide, it will be remembered, is the combustible gas that passes from the surface of a mass of incandescent carbon. It is a state of incomplete combustion, and requires yet another part of oxygen to form carbonic acid, the end of or completed combustion.

The Ponsard system, then, is the heating and expansion of the air, so that in coming in contact with the carbon of the fuel it will take up but its single part of the oxygen, forming carbonic oxide, rather than two parts, forming the incombustible carbonic acid. This second step is also an approach towards the almost divine consummation—a perfect utilization of the heat of carbon.

The generation of Producer-gas to-day commands a considerable amount of mental activity—probably more than ever heretofore. Wherever the gases—the incombustible as well as the combustible—are used immediately upon their production, and while at their highest temperature, this system may have some influence in utilization; but, wherever the gases must be stored, it is practically worthless. In large factories this process has some economy and effectiveness—the apparatus is simple and cheap, and the producer can stand by the side of the place where the heating is required. The whole system may be summed up as a more complete method of burning the carbonic oxide of an ordinary fire, or what is commonly known in trade as gas-burning.

The chief difficulty in this and the Water-gas process heretofore described lies in having to use the atmosphere, either altogether or periodically and alternately to maintain continuous combustion. The air is composed of one part oxygen and four parts nitrogen ; the latter a worthless ingredient for combustion ; and were the atmosphere not thus composed and diluted with nitrogen, the oxygen would burn everything, destroy all life, etc. This being the case, it is a hindrance when we come to create the artificial fire, and has in the past constituted the great barrier to the rapid development of utilizing carbon and the production of the most economical and perfect fuels. And, further, in the fact that it stores a vast amount of heat and carries it away with it, renders it worse than useless in all processes of combustion, however important a factor it may be to the outside world, notwithstanding.

Producer-gas, from the St. Gobain analysis, consists substantially as follows:

| | | | | |
|---|---|---|---|---|
| Hydrogen, | 4 | to | 11 | per cent. |
| Carbonic oxide, | 15 | " | 19 | " " |
| Carbonic acid, | 6 | " | 7 | " " |
| Nitrogen, | 75 | " | 63 | " " |

The heavy burden of nitrogen will be observed in the above. This element and the carbonic acid are destructive to combustion. More recent processes have, however, introduced steam with the air, making a steam and air-blast, which adds to the hydrogen and carbonic oxide of the compound. The introduction of steam greatly redeems the producer system, and obtains the greatest modicum of profit from the crude operation. It bears only a comparative relation to the *intensity* of water-gas, and is only a profitable factor in the immediate vicinity of its use.

To accomplish the act of continuous combustion by obtaining a supply of oxygen without a recourse to the air, or, in other words, to obtain the oxygen without the nitrogen, is the culminating scene in the great drama. We shall know little of furnace heat until we can have the pure carbon and the pure oxygen;—in this period the present possibilities of temperatures will appear to be insignificant. This period has undoubtedly been reached in the perfection of the devices to secure continuous combustion without the resort to the atmosphere in any way, or at any time, after the mere starting of the fire. This new product consists of a combination of hydrogen and carbonic oxide, obtained from incandescent carbon and dissociated water, which may be created continuously, practically without waste, and stored indefinitely without deterioration.

## COMBINED HYDROGEN AND CARBONIC OXIDE GAS.

This has been generally denominated Fuel Water-Gas, and, while there may be scarcely any new elements, the difference being merely that of proportion from what has already been described at length and commented upon, yet the devices are comparatively new and are awaiting introduction.

This new process will involve more than one cupola or furnace, and the exclusion of the atmosphere in the operation—the reliance for oxygen being almost, if not quite, entirely upon the dissociated water for the supply. Water was discovered by Cavendish and Lavoisier to contain, by weight, 86.87 of oxygen and 13.13 of hydrogen, and, by volume, 12 of oxygen and 22.9 of hydrogen; in general terms, two volumes of hydrogen to one of oxygen form water.

It has been noticed that the loss in the manufacture of water-gas was occasioned by the cooling of the regenerators, in dissociating the water vapor and the heat carried away by the departing gases, until, without very expensive and complicated appliances, there was little saving or gain.

The use of more than one furnace combines the elements of the producer already described, and constitutes the second as a regenerator. The steam is dissociated in the first, passing off as hydrogen, carbonic oxide, and carbonic acid gas, and thence, entering the second furnace, the carbonic acid takes up another part of carbon and turns the incombustible carbonic acid into carbonic oxide—a highly inflammable element. It will be seen that the regenerating process here described takes place in the incandescent coals of the second furnace.

When the steam enters the first furnace, the fuel of which is red-hot, cherry-red, or in a primary state of incandescence, it passes away as hydrogen, carbonic oxide, and carbonic acid-gas. The oxygen of the water has a great chemical affinity for the carbon when it is liberated from its union with the hydrogen, which is accomplished at a temperature of about 960° F., or at cherry-red color of incandescence. The chemist Langlois establishes the following table, showing the composition by volume of the gases discharged from the first furnace maintained at a low temperature:

| GAS. | 1st Jar. | 2d Jar. | 3d Jar. | 4th Jar. | 5th Jar. | 6th Jar. | 7th Jar. |
|---|---|---|---|---|---|---|---|
| Hydrogen, | 59.11 | 58.64 | 60.55 | 60.48 | 60.18 | 60.37 | 59.86 |
| Carbonic Oxide, | 21.89 | 26.07 | 20.00 | 20.83 | 21.42 | 19.31 | 20.76 |
| Carbonic Acid, | 19.00 | 15.29 | 19.45 | 18.69 | 18.40 | 20.32 | 19.38 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

The variation exhibited in these results undoubtedly denotes the differences of temperature applied to the jars in which the experiments were made. It will be remembered that the preceding table is the result of dissociation at a *low temperature*—as low as can be maintained in a furnace.

It gives us the substantial fact, however, of the gases produced in the first furnace in question. This product is passed to the second furnace, in which the incandescent fuel gives off carbon to unite with the oxygen in the carbonic acid, transforming it into carbonic oxide, the hydrogen and the carbonic oxide passing undisturbed in their relations, proportions, or affinities, owing to the absence of any excess or uncombined oxygen. The result of the second furnace, then, is the two proportions of hydrogen and carbonic oxide of the highest inflammability, and an intensity—surpassed only by electricity. The reason that this particular operation takes place is that the carbon and oxygen have the greatest affinity for each other—greater than for hydrogen, and, as in the carbonic oxide the affinity is already complete, there is no chemical process possible except the formation of the carbonic oxide from the carbonic acid.

The act of dissociation is an exhaustive drain upon the first fire, while the passage of the gases through the second acts to stimulate and revive it. The first fire, then, will continue to grow dull in proportion to the amount of labor it is performing in dissociation. In order to counteract these influences a change of direction of current may be arranged for, and, by reversing, the second may become the dissociating chamber or furnace, and the first the regenerator, thus alternating for any length of time, and making the process practically continuous, and accomplishing possibly, the solution of the great problem of an economical fuel.

Returning, again, to furnace number one, and raising the temperature to a red-white heat, the composition of the gases in the decomposition are found to be as follows in two analyses:

| | 1st Analysis. | 2d Analysis. |
|---|---|---|
| Hydrogen, | 52.64 | 49.62 |
| Marsh gas, | . . . | 2.17 |
| Carbonic oxide, | 41.36 | 42.21 |
| Carbonic acid, | 6.00 | 6.00 |
| | 100.00 | 100.00 |

Comparing this *high-temperature* table with the preceding *low-temperature* table, it will be seen that the hydrogen decreases and the carbonic acid is reduced to a minimum, while the carbonic oxide increases. The loss of the hydrogen is to be deplored, and, as the carbonic acid can be changed into carbonic oxide in the second furnace, the element of economy and usefulness seems to be derived from the low rather than the high-temperature process. The loss of hydrogen can never be regained, and the hydrogen is the more powerful element of the two combustibles; so that any process which enhances the production of hydrogen, even if accompanied by a larger proportion of carbonic acid is to be preferred, as the carbonic acid can be readily restored to carbonic oxide.

The decomposition in the first furnace sets free the hydrogen by volume two, and by weight one-eighth, and leaves the oxygen by volume one and by weight seven-eighths,—free to make its union with the carbon. The act of setting free the hydrogen and utilizing the oxygen to combine with the carbon is the point to be obtained. This process cannot be carried on indefinitely in the same furnace, as the requirements of decomposition and the effects of moisture will exhaust the activity of the union of the carbon and oxygen: hence, supplementary appliances must be put into operation, so that, by the time the vapor reaches the incandescent fuel, the temperature is already, if not quite, at the point of decomposition. The oxygen, as soon as freed from the hydrogen, rushes to unite with carbon and constitutes the combustion of the furnace. By regulation of the steam used, the quantity of oxygen can be regulated, and the furnace kept manufacturing the greatest possible quantity of the oxide rather than the acid. If the supply of oxygen is sufficient, the oxide is formed instead of the acid.

To consume 100 pounds of coal about 266 pounds of oxygen is required.

The theoretical yield of 100 pounds of pure anthracite in gaseous products is stated to be 228.22 pounds and 1,000 cubic feet of hydrogen and carbonic oxide gas weighs 42.01 pounds; so that 100 pounds of pure anthracite would yield about 5,500 cubic feet of gas. But anthracite is not pure carbon, though coming nearly to it. The following analysis represents the combustible quality of good Pennsylvania anthracite:

| | |
|---|---|
| Carbon, | 94.63 |
| Hydrogen, | 2.73 |
| Oxygen, | 1.28 |
| Nitrogen, | 1.36 |
| | 100.00 |

Barr, page 272, commenting upon the above table, says:

If we assume that 2.73 parts of hydrogen are evolved in combination with 8.19 parts of carbon in the form of marsh gas, 100 parts of anthracite, free from ash, would require for complete conversion of the residual 86.44 parts of carbon to carbonic oxide — 115.25 — 1.28 = 113.97 parts, by weight of oxygen, or, 128.22 parts of water. The gaseous products of transformation of one hundred pounds of pure anthracite would then be:

| | |
|---|---|
| Nitrogen, | 1.36 |
| Carbonic oxide, | 201.69 |
| Hydrogen, | 14.25 |
| Marsh gas, | 10.92 |
| | 228.22 |

Or reduced to percentages:

| | Weight. | Volume. |
|---|---|---|
| Nitrogen, | 0.60 | 0.32 |
| Carbonic oxide, | 88.38 | 47.89 |
| Hydrogen, | 6.24 | 47.25 |
| Marsh gas, | 4.78 | 4.54 |
| | 100.00 | 100.00 |

For all purposes of practical calculation, it may be assumed that the method of production described can, in round numbers, be made to average nearly 5,000 cubic feet of gas to every 100 pounds of coal, or nearly 100,000 cubic feet of gas to the net ton of coal or culm. Of course, for so high a yield the best possible appliances are required, and those which shall register the least loss. Unquestionably these devices are upon the high road to perfection already.

## ARTIFICIAL GAS LESS THAN TWO CENTS PER THOUSAND CUBIC FEET.

The contemplation of the gas subject in the anthracite coal fields is almost like an Aladdin story. In scientific nomenclature, it may properly be designated as anthracite gas. Based upon the foregoing calculations, we have the cost per ton at the producer:

| | |
|---|---|
| One ton of waste at producer, | $ 50 |
| Labor handling same per ton, | 30 |
| Expenses of plant per ton, | 1.00 |
| 100,000 cubic feet, | $1.80 |

or less than two cents per thousand cubic feet.

Incredible as may seem these figures, yet they are certainly approximately true, and will, undoubtedly, in time, be fully verified. The perfection of appliances is going on at a most rapid pace.

The presence of the large proportions of hydrogen and carbonic oxide in this gas constitutes the intensest known heating element, and defies natural gas with its marsh gas and its heavy hydro carbons, which have more illuminating, but less heating power. Prof. S. A. Ford, chemist of the Edgar Thompson Steel Works, making comparison between the effectiveness of Pittsburgh soft coal and the average quality of natural gas, reaches a conclusion that 1,000 cubic feet of gas equals 62.97 pounds. The equivalent of 1,000 feet of gas of a higher quality is 20 pounds of anthracite. There is no immediate fuel possibility equal to anthracite gas.

## COAL IN THE PIT RAISED AS GAS

It is by no means an unreasonable expectation that the producer may be placed in the mine, and the product piped to the surface and distributed. The various steps of lessening labor, and the increase of conveniences are destined to come upon us. It is certain that the "art of doing" will be to let nature carry all the burden that ingenuity can shoulder off upon her, and that the "secret of living" will be found to exist in lightening care and burden now resting upon the backs of men. The use of fuel is the great civilizer, and in proportion as we have plodded along in old ways, shall we seize upon the new possibilities that are already at our doors. The coming age will use fuel under the new conditions and powers, that will make our present brilliant progress appear dull indeed.

## NATURAL GAS AND ITS PROSPECT.

Unquestionably the great centers of manufacturing industry east of the Mississippi lie in the northeast, the Lackawanna, and Wyoming coal field, and in the southwest, the Pittsburgh, and Allegheny coal, oil, and gas district, of Pennsylvania. The future is destined to be one of brilliant contest, and the result of doubtful supremacy, perhaps. The great northern anthracite field, of which Scranton is the natural center, cannot be robbed of its untold mineral wealth in this age or the next, and it will continue to present superior advantages as its infinite resources are developed and brought to the attention of the country.

Like many another thing, Natural Gas is no new discovery. It dates back before the Christian Era, and the Chinese observed it 3,000 years ago, and have obtained supplies in the Tsien Luon Tsing, from wells 3,000 feet deep. It was early a symbol of worship, and Julius Cæsar warmed his hands over a "burning well," in Gaul.

The record of "burning springs" dates very far back among the early settlers of this country, as well as being a part of the legendary lore of the Aborigines. In 1775, Washington deeded a tract in the Kanawha Valley, on which there was a "burning spring." It was first used in Fredonia, N. Y., in 1821, and the village was illuminated on the occasion of the visit of Lafayette, in 1824. It is a natural companion to the oil district, and is inseparable from carboniferous deposits.

Its distribution is very wide over the known world, and it is materially the same in China, on the Caspian Sea, and in America. It is by no means a mysterious visitor, yet its late arrival in such quantities as are developed in the southwest of the State has occasioned surprise. Its intrinsic value will consist in its quantity and its persistence of pressure; both of which qualities are already becoming very much involved in apprehension or in doubt.

## PROBABLE DURATION OF NATURAL GAS.

Could any locality be assured of an unfailing and an indefinite supply of natural gas, it would undoubtedly possess ideal attractions to domestic and industrial life. Were it not for its fitful stages, both in regard to quality and to exhaustion, it might possess a most determined future; but every record and the accumulation of experience, with some rare exceptions, serve to foretell the period of its existence. "Its life is short," seems written over every gas district.

Our esteemed State Geologist, Professer J. P. Lesley, of Philadelphia, whose consideration of the geology of the State and especially of coal, oil and gas, make him worthy of an unfaltering confidence, expresses his conviction in the following forceful terms.

Prof. Lesley, in speaking of the durability of our natural gas supply, says:

"I take this opportunity to express my opinion in the strongest terms, that the amazing exhibition of oil and gas which has characterized the last twenty years, and will probably characterize the next ten or twenty years, is, nevertheless, not only geologically but historically, a temporary and vanishing phenomenon—one which young men will live to see come to its natural end. And this opinion I do not entertain in any loose or unreasonable form; it is the result of both an active and a thoughtful acquaintance with the subject. From the time that Colonel Drake sunk the first well on the plains of Titusville I have professionally participated in the history of the oil and gas developments, and believe myself to be familiar with whatever has been said and done in the premises; and there does not remain upon my mind a shadow of doubt respecting the practical extinction, in the comparatively near future, of that great commerce in oil, of which the people of Pennsylvania have foolishly taken so little advantage, when they might have accumulated from its sale in all quarters of the world a provision of moneyed wealth unheard of in the history of our race. The opportunity is indeed still offered; but it is steadily diminishing, and in a few years it will entirely pass away never to return again. For I am no geologist if it be true that the manufacture of oil in the laboratory of nature is still going on at the hundredth or thousandth part of the rate of its exhaustion. And the science of geology may as well be abandoned as a guide if events prove that such a production of oil in Western Pennsylvania as our statistics exhibit can continue for successive generations. It cannot be; there is a limited amount. Our children will merely, and with difficulty, drain the dregs."

"I hold the same opinion respecting gas, and for the same reasons; with the difference merely that the end will certainly come sooner, and be all the more hastened by the multiplication of the gas wells, and of the fire-boxes and furnaces to which it is led."

"I will add two opinions of my own, leaving them to stand for what they are worth:

"1. As gas is a direct product of petroleum by spontaneous evaporation, the life of the gas production will be limited by the amount of the volatile elements held in a definitely limited quantity of petroleum existing underground; and therefore those who are producing and using this enormously valuable mineral substance should take every precaution to prevent its waste, seeing that it is bound to come to an end.*

*"The most noteworthy point in the composition of well-gas is its frequent and rapid variation.

"It has been an embarrassment to some consumers that there was not sufficient steadiness in the heat produced. One day the required heat was obtained at a certain pressure; the next day the same degree of heat could not be got from the same amount of gas.

"Most operators charge this variation in heat to a deficiency of pressure, *i. e.*, amount of gas delivered. But the system of distribution is so well planned, and the regulation of pressure so skillfully accomplished by telegraphic messages to employes at various points where shut-off gates are located, that some better explanation is needed.

"Chemical analyses have furnished the explanation, but only by opening up to view a most extraordinary and unforeseen fact, viz.: That the gas blown off from a well varies in its essential quality from day to day.

"Analyses of two samples of gas from the same well have exhibited the startling fact that at one time the gas is composed of only 35 or 40 per cent of the marsh-gas element, and at another time of 70 or 80 per cent, or even more.

"Of course the heating power falls as the percentage of the ultra-hydrogen element ($CH_4$) rises. The discovery is so recent, that no account of the causes at work underground can be given. The subject requires investigation, for its importance cannot be overestimated. But if the quality of gas from each well is constantly varying, the first way to meet the difficulty that suggests itself is to tap as many wells as possible into one pipe-line, so as to mix their different gases together, and give a chance for the variations to counterbalance each other.

"When the natural gas production comes to an end, it seems to be safe to say that a vast manufacture of artificial gas will take its place, and that the artificial gas will be less variable in its heat-producing quality."

"2. I have for a long time looked upon the extension of the Butler oil belt in a general southwest direction through Washington and Green counties and into Virginia as probable, and I believe now more confidently than ever, since the drilling of the Washington district wells, that a considerable addition to our oil and gas wealth will be made in future years by a series of oil and gas strikes at greater depths in that direction. But thus far facts all point to a greater production of gas than of oil from that region."

It would seem as if there were little to be uttered after so confident an expression from so eminent an authority.

A reference to the neighboring state, Ohio, reveals a similar sentiment.

Professor Edward Orton, State Geologist, in a report upon Natural Gas, expresses his doubtful state of mind as to the gas for industrial purposes:

"I cannot discuss at this time the supplies of gas derived from the Berea Grit (the Murraysville sand and the Gantz sand, as commonly received) in eastern Ohio. Our manufacturers are not happy over their failures to secure good and permanent flows from the great Pennsylvania horizon. They have found some fairly large wells in the Ohio valley, but where the wells have been large they have not proved permanent. The lights are burning low through the Steubenville and Wellsburg district, the fatal salt water dropsy threatening or destroying them all. *Structure* only serves them half way. The dip has been arrested, but the arch was not completed.

"There is one source of natural gas in Ohio which, though not attractive to the manufacturer because of its lack of pressure and force, still is diffusing and is sure to diffuse more widely a vast amount of domestic comfort. I refer to the gas supply of the black or Ohio shale. This formation has 300 miles of outcrop in the State from the Pennsylvania line along the shore of Lake Erie as far west as Elyria, and thence south to Portsmouth, on the Ohio river, and almost everywhere along this line weak supplies can be easily obtained, yielding 1 to 25,000 cubic feet per day. The gas proves fairly permanent. Some wells that have been running 16 years are producing 1,500 feet to-day, without having cost their owners a dollar beyond the initial outlay for drilling.

"This horizon is happily adapted to the production of household supplies, on every account, and some wells have been recently found, along the shore of Lake Erie, that are large enough to make some figure in supplving power for manufacturers, if they hold out as well as the weaker ones do.

"The outcome of this great and wide-spread interest in natural gas ought to be a clearer recognition of the value of gaseous fuel, and, coincident with this recognition, a greatly improved and cheapened manufacture of artificial gas. This is the goal to which our efforts in this direction should all tend. Under the insane competition that dominates in American business, natural gas is sure to run a short but brilliant race. Let us hope that it will give us something vastly better than itself, viz.: a greatly improved supply of artificial gaseous fuel."

Again, the following is taken from the report of Mr. I. C. White, of the U. S. Geological Survey, and is contributary information upon this interesting subject. He says:

"If our main proposition be true, viz.: that the principal supplies of natural gas have been stored along the *arches* of the rocks, then the question of *location* must have a very important bearing upon the life of any particular gas field; for whatever may have been the source or origin of the gas, whether as a by-product in the genesis of oil (as much of it certainly is), or from the action of heated saline water on carbonaceous material, thus originating the Murraysville, or odorless gas without any oil, as some claim, or in what way soever it is produced, the wells along the arches would have a much longer lease of life.

"Mr. Carll has recently sounded a note of warning through the columns of the *Age*, to which those who think the supply inexhaustible would do well to take heed: for certain it is that many wells once large have long since ceased to flow. It is true that many of these have been choked up with salt because the water was not cased off, and the casing having been taken out, a column of water many hundred feet high has imprisoned others, but there is reason for believing that still others have failed because the source of supply was exhausted. On the 'anticlinal theory,' it would be expected that all wells not situated near prominent arches, nor at the upturned ends of vanishing synclines, could not have a long life, since the contents of the reservoir upon which they can draw must necessarily be of limited extent. But not so with those situated along the prominent arches, like that at Cannonsburg, Murraysville and Grapeville, for here the quantity in any one sand will be vastly greater than where the rocks are undisturbed, and the disturbance itself will have fractured the rocks and thus given access to many other reservoirs below the one from which the well draws immediately.

"The first Murraysville well has been delivering from fifteen to twenty million feet of gas daily for nearly ten years, and yet with many other wells in close proximity, its volume has not yet been appreciably diminished. Hence there is good reason for believing that the gas wells situated on the prominent arches may have a much longer life than others not so fortunately placed, and that the immense amount of capital invested in pipe lines to them, will receive an adequate return before the gas shall have been exhausted. Nothing but time can determine the life of gas territory situated upon a well developed arch, like the Murraysville or Saltsburg anticlines.

The *American Manufacturer and Iron World*, of Pittsburg, thus presents the case in reference to the supply of Natural Gas:

### SUPPLY AND EXHAUSTION.

"That the supply of gas is limited, and that it will ultimately be exhausted, does not admit of question In this belief all unite. How long the supply will last is the subject of argument. Experience furnishes some information on this point, and supplies an imperfect basis of calculation, but after all there is but little data upon which to rest any reasonable prediction. Experience shows that in certain districts the supply at individual wells is soon exhausted, and the amount furnished by new wells when first bored is a constantly decreasing quantity. In other districts the life of the wells is longer, but the earlier wells are now quite weak or exhausted entirely, and the new wells sunk do not produce any such amounts of gas as those first drilled. In still other districts the great 'gassers' at first struck have been pouring out gas by the million feet per day for years without any apparent diminution in pressure or volume. It will be found as a rule that the shallowest well and those weakest when first drilled have the shortest existence. This is only a general rule. Sometimes an enormous 'roarer' will be exhausted in a short time, but these wells are usually shallow. Mr. H. M. Chance has estimated the total supply and the probabilities of the exhaustion of the gas in a very ingenious manner. He assumes as the basis of his calculation that the gas exists in porous sandstone reservoirs, and that the yield of any sand rock will depend upon its thickness, its porosity and the pressure under which the gas exists in the rock. He assumes the porosity to be one-sixth of the bulk of the rock, the pressure 750 pounds per square inch in the rock, and the porous portion of the rock in Western Pennsylvania 30 feet. With this data he estimates the amount of gas per square mile as 7,000,000,000 cubic feet. Assuming the ratio of productive to non-productive gas territory to be the same as of oil territory in the Butler, Clarion and Venango districts, viz., one-tenth, there would be within a radius of 30 miles in every direction from Pittsburg about 283 square miles of productive territory, which at 7,000,000,000 cubic feet of gas per mile would yield 1,981,000 million cubic feet of gas. Estimating the consumption at 600,000,000 cubic feet daily, and the waste at 100,000,000 cubic feet, a total of 255,500 million feet per annum, the total contents of the rock

(30 feet, one-sixth porosity, one-tenth productive area, 750 lb. pressure), within thirty miles of Pittsburg would be exhausted in about eight years."

*Engineering*, a journal devoted to the interests and resources of the country, speaks comprehensively upon the general subject, and, while predicting the exhaustion of the natural in the possibilities of artificial gas, it says:

"We see no cause for anxiety. That the supply will certainly give out, we believe has already been proved by the rapid reduction of pressure at the wells now running; but the advantages that Pittsburg is now enjoying above every other part of the country will certainly lead to the adoption of gaseous fuel elsewhere. Gaseous fuel is beyond all question the fuel of the future, and those who have not been favored by nature with a supply ready made must and will make it from coal. Manufacturing industries, and more particularly metallurgical industries, such as iron and steel manufacture, glass, brick and pottery making, smelting and refining of metals, etc., will hereafter depend almost exclusively on gas.

"Water gas is the most concentrated form of gaseous fuel that we can expect to produce economically, and the present revolution caused in Pittsburg by the use of Natural Gas will quickly be followed by a no less important revolution in the East and elsewhere by the general use of Water Gas. When our anthracite, both that now lying waste in our culm-banks and that freshly mined, will be converted into Water Gas, and brought to our centers of consumption through large mains, or be manufactured from coal at the great centers in large and economical establishments.

"With Water Gas at ten cents per 1,000 feet the East will be able to compete with Pittsburg in many industries now threatened by the economy of Natural Gas over coal.

"In Pittsburg, Water Gas at say seven cents, and Natural Gas at eight cents, are cheaper than the phenomenally low priced coal that this great industrial center has been blessed with.

"In developing the use of Water Gas, our Eastern industries will not only be saving themselves from extinction, but will be preparing the means by which the great industries of Pittsburg will prosper and grow without interruption or set-back when the supply of Natural Gas has been exhausted."

The *American Manufacturer*, of January 8th, wisely presents the natural gas question with reference to Pittsburg and its manufacturing interests in the true light. It says:

"There is a great deal of misapprehension in the country as to the advantage to Pittsburg manufacturers of the existence of natural gas in the neighborhood of that city. But little gas has been found in the city proper, the chief sources being Washington County, Murraysville in Westmoreland County, and in the neighborhood of Tarentum in Alleghany County. Some gas is found at Wilkinsburg, just at the city line, at the noted Westinghouse well. The gas from these wells has to be brought from five to twenty-two or twenty-three miles to reach the Pittsburg manufacturers; so it will be seen that the gas is not in Pittsburg proper, but has to be brought to the mills and factories through a system of pipeage requiring a considerable outlay.

"But the chief point to be noticed in this connection is that the Pittsburg manufacturers do not own the gas. To Some extent they may be stockholders in the companies controlling the wells, but as a rule they purchase their gas from the parties supplying it, and the rate at which it is purchased is not such as to give the mills and factories so great an advantage in the cost of their fuel as has been supposed. The policy of the gas companies seems to be to ask for the gas fuel necessary to make a ton of iron somewhat near the price that the mills have heretofore paid for the coal used sufficient for that purpose, and the advantage to the manufacturers is in the smaller number of men necessary and the greater evenness of the heat, though in this latter respect there are some drawbacks, owing to the irregular supply of gas at times. While the saving and the advantages in the use of gas are considerable, they are by no means as great as is generally supposed, or as large as they would be if the wells were owned by the manufacturers themselves. In saying this, we are not to be understood as in any way attempting to belittle the great advantage to Pittsburg as a community in the possession of this remarkable fuel, but only to indicate that to individual manufacturers its value is not as great as has been supposed, nor does its possession enable these manufacturers to produce iron at very greatly reduced rates. When the competition becomes more decided, the gas may be furnished at a lower rate."

The following complete and exhaustive report presents the fitful qualities of Natural Gas and its comparative value with Pittsburg coal. It will be seen to be behind the artificial. The report is

BY S. A. FORD, CHEMIST EDGAR THOMSON STEEL WORKS.

"So much has been claimed for Natural Gas as regards the superiority of its heating properties as compared with coal that some analyses of this gas, together with calculations showing the comparison between its heating power and that of coal, may be of interest to your readers.

"These calculations are, of course, theoretical in both cases, and it must not be imagined that the total amount of heat in a ton of coal or in a 1,000 cubic feet of natural gas can ever be fully utilized.

"In making these calculations, I employed as a basis what in my estimation was a gas of an average chemical composition, as *I have found that gas from the same well varies continually in its composition.* Thus, samples of gas from the same well, but taken on different days, vary in *nitrogen from 23 per cent to nil*, carbonic acid from 2 per cent to nil, oxygen from 4 per cent to .4 per cent, and so with all the component gases.

"Before giving the theoretical heating power of a 1,000 cubic feet of this gas, I will note a few analyses. The first four are of gas from the same well, samples taken on the same day that they were analyzed. The last two are from two different wells in the East Liberty district.

"I also give a few analyses of Siemens producer gas. The immense heating power of the natural gas over the Siemens may be seen at a glance when compared bulk for bulk:

NATURAL GAS.

| | 1 | 2. | 3. | 4. | 5. | 6. |
|---|---|---|---|---|---|---|
| When Tested | Oct. 28, 1884. | Oct. 29, 1884. | Oct. 24, 1884. | Dec. 4, 1884. | Oct. 18, 1884. | Oct. 25, 1884. |
| | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. |
| Carbonic acid, | .8 | .6 | nil. | .4 | nil. | .3 |
| Carbonic oxide, | 1.0 | .8 | .58 | .4 | .1 | .6 |
| Oxygen, | 1.1 | .8 | .78 | .8 | 2.1 | 1.2 |
| Olefiant gas, | .7 | .8 | .98 | .6 | .8 | .6 |
| Ethylic hydride, | 3.6 | 5.5 | 7.92 | 12.3 | 5.2 | 4.8 |
| Marsh gas, | 72.18 | 65.25 | 60.70 | 49.58 | 57.85 | 75.16 |
| Hydrogen, | 20.62 | 26.16 | 29.03 | 35.92 | 9.64 | 14.45 |
| Nitrogen, | nil. | nil. | nil. | nil. | 23.41 | 2.89 |
| Heat units, | 728,746 | 698,853 | 627,170 | 745,813 | 592,380 | 745,591 |

SIEMENS PRODUDER GAS.*

| | | | | | |
|---|---|---|---|---|---|
| Carbonic acid, | 3.9 | 8.7 | 9.3 | 1.5 | 6.1 |
| Carbonic oxide, | 27.3 | 20. | 16.5 | 23.6 | 22.3 |
| Hydrogen, | | 8.7 | 8.6 | 6. | 28.7 |
| Marsh gas, | 1.4 | 1.2 | 2.7 | 3. | 1. |
| Nitrogen, | 67.4 | 61.4 | 62.9 | 65.9 | 41.9 |
| Heat units, | 93,966 | 97,184 | 99,074 | 114,939 | 164,164 |

"We will now see how the natural gas compares with coal, weight for weight, or in other words, how many cubic feet of gas will contain as many heat units as a given weight of coal—say a ton.

"In order to accomplish this end we will be obliged, as I have before said, to assume as a basis for our calculations what I consider a gas of an average chemical composition, viz.:

*See Vol. XI., p 300, Transactions of American Institute of Mining Engineers.

| | Per cent. |
|---|---|
| Carbonic acid, | .6 |
| " oxide, | .6 |
| Oxygen, | .8 |
| Olefiant gas, | 1.00 |
| Ethylic hydride, | 5.00 |
| Marsh gas, | 67.00 |
| Hydrogen, | 22.00 |
| Nitrogen, | 3.00 |

"Now, by the specific gravity of these gases we find that 100 liters of this gas will weigh 64.8585 grammes, thus:

| | | | | |
|---|---|---|---|---|
| Marsh gas, | 67. | L. weighs, | 48.0256 | grammes. |
| Olefiant gas, | 1. | " | 1.2534 | " |
| Ethylic hydride, | 5. | " | 6.7200 | " |
| Hydrogen, | 22. | " | 1.9712 | " |
| Nitrogen, | 3. | " | 3.7652 | " |
| Carbonic acid, | .6 | " | 1.2257 | " |
| " oxide, | .6 | " | .7526 | " |
| Oxygen | .8 | " | 1.1468 | " |
| Total, | | | 64.8585 | |

"Then if we take heat units of these gases we will find that—

| | | | | | |
|---|---|---|---|---|---|
| Marsh gas, | 48.0256 | grms. | contain | 627,358 | heat units. |
| Olefiant gas, | 1.2534 | " | " | 14,910 | " |
| Ethylic hydride, | 6.7200 | " | " | 77,679 | " |
| Hydrogen, | 1.9712 | " | " | 67,939 | " |
| Nitrogen, | 3.7630 | " | " | | " |
| Carbonic oxide, | .7526 | " | " | 1,808 | " |
| " acid, | 1.2257 | " | " | | " |
| Oyxygen, | 1.1468 | " | " | | |
| | | | | | " |
| Total, | 64.8585 | | | 789,694 | " |

"64.8585 grms. is almost exactly 1000 grains, and one cubic foot of this gas will weigh 267.9 grains, then the 100 litres or 64.8585 grms. or 1000 grains is 3.761 cubic feet.

"3.761 cubic feet of this gas contains 789,694 heat units and 1000 cubic feet will contain 210,069,604 heat units.

"Now 1000 cubic feet of this gas will weigh 265,887 grains, or in round numbers, 38 lbs. av.

"We find that 64.8585 grms., or 1000 grs. of carbon contain 52.4046 heat units, and 265.887 grains, or 38 lbs. of carbon contain 139,398,896 heat units. Then 57.25 lbs. of carbon will contain the same number of heat units as the 1000 cubic feet of the Natural Gas, viz., 210,069,604.

"Now if we say that coke contains in round numbers 90 per cent carbon, then we will have 62.97 lbs. of coke, equal in heat units to 1000 cubic feet of Natural Gas.

"Then if a ton of coke, or 2000 lbs., cost $2.50, 62.97 lbs will cost 7 8-10 cents, or 1,000 cubic feet of gas is worth 7 8-10 for its heating power.

"We will now compare the heating power of this gas with coal, taking as a basis a coal slightly above the general average of the Pittsburg coal, viz.:

| | |
|---|---|
| Carbon, | 82.75 |
| Hydrogen, | 5.31 |
| Nitrogen, | 1.04 |
| Sulphur, | .95 |
| Oxygen, | 4.64 |
| Ash, | 5.31 |

"We find that 38 lbs. of this coal contains 146,903,820 heat units, then 54.4 lbs. of this coal contain 210,069,604 heat units, or 54.4 lbs. of this coal is equal in its heating power to 1000 cubic feet of the natural gas.

"If our coal costs us $1.20 per ton of 2000 lbs, then the 54.4 lbs. costs 3¼ cents, and 1000 cubic feet of gas is worth for its heat units 3¼ cents.

"As the price of coal increases or decreases the value of the gas will naturally vary in like proportions.

"Thus with the price of coal at $2.50 per ton, this gas will be worth 6 8-10 cents per 1000 cubic feet.

"If 54.4 lbs. of coal is equal to 1000 cubic feet of gas, then 1 ton of coal is equal to 36,764 cubic feet.

"In these calculations of the heating power of gas and coal no account is, of course, taken of the loss of heat by radiation, etc. My object has been to compare these two fuels merely as regards their actual value in heat units.

"In collecting samples of this gas I have noted some very interesting deposits from the wells. Thus in one well the pipe was nearly filled up with a soft grayish white material, which proved on testing to be chloride of calcium. In another well, soon after the gas vein had been struck, crystals of carbonate of ammonia were thrown out, and upon testing the gas I found a considerable amount of that alkali, and with this well no chloride of calcium was observed until about two months after the gas had been struck."

The mechanical difficulties of piping long distances are very great, and are the source of great annoyance, inconvenience, and expense. Beyond 30 miles it is impracticable; even at 20 miles the pressure will fall from 80 to 90 per cent.

The failure of large wells in many localities is arousing apprehension, and even in the immediate vicinity or within the gas district, attention is being given to the manufacture of an artificial gas in anticipation of the failure of Nature's supply. The discovery of the natural gas has already served to stimulate the growth of an intelligence that, with the material given, can outdo the rude chemistry of the earth's crust in the manufacture of the artificial. The days of solid fuel, with their toil, smut, and waste, are numbered; and the day of universal application of gaseous fuel will make the beginning of a period of unprecedented progress.

---

## AMOUNT OF CULM OR COAL WASTE.

The quantity of this material cannot be closely estimated. It has already reached millions upon millions of tons, and it lies upon every hand in great mountain piles, and can be had for the taking. The total yield of the Lackawanna Valley, since anthracite mining began in 1829, and carried to a foreign as distinguished from a home market, has reached the enormous total of 167,109,600 tons. To these figures add, say 40,000,000 tons of home consumption, and we have upwards of 200,000,000 tons. Waste may be variously estimated; but, taking the early wasteful, as well as the later more economical period into consideration, there can not be less than 20 per cent. or about 40,000,000 tons of this valuable fuel now lying above ground.

Allowing one-half of the amount of this tonnage to be waste, by the weathering of the coal, by use in filling and grading, and by firing at the culm bank, and we have yet 20,000,000 tons ; and we are increasing the amount yearly by a volume of 2,000,000 tons, an aggregate of natural substance going to waste unheard of and unparalleled.

---

## GAS FROM ANTHRACITE CULM.

Taking the estimated available coal waste at 20,000,000 tons, and calculating at the rate of production into gas of 100,000 cubic feet per ton, we have a total of 2,000,000,000,000, or, 2,000,000 million cubic feet of gas, or a quantity greater than that computed by Mr. H. M. Chance, of the Geological Survey, to exist in the gas territory of the west.

The volume of waste output is going on at present rate at 2,000,000 tons per annum, or equivalent, as we have seen, to 200,000,000,000, or 200,000 million cubic feet of gas. No natural gas territory can ever hope to equal this in substantial advantages for industrial and domestic purposes.

Add to these glittering figures, the fact that all the computations of attending expenses, are in favor of the culm gas as against the natural,—the high pressure of the latter must always produce waste, and the cost of a short-lived well is equal to that of any producer. Having pressure under complete control, and the producer plant being simple, the entire advantage is with the artificial gas. The question is, will all these vast resources ever be utilized? The answer may come through the following calculations:

## DEMAND FOR POWER.

The inseparable ally of civilization is power. The demand is growing everywhere. The following tabular comparison between the United States Census Reports in 1870 and 1880, make a plain exposition of the subject:

| | Water Wheels. | Horse Power. | Engines. | Horse Power. | Total. |
|---|---|---|---|---|---|
| 1880............ | 55,404 | 1,225,379 | 56,483 | 2,185,458 | 3,410,837 |
| 1870............ | 51,018 | 1,130,431 | 40,191 | 1,215,711 | 2,346,142 |
| Per ct. of increase, | 8.60 | 8.40 | 40.54 | 79.77 | 45.38 |

The same authority gives us an increase of horse-power to hand-power of 1.14 in 1870 to 1.25 in 1880. In 1870 steam and water-power were nearly equal, steam-power being 51.82 per cent and water-power 48.18 per cent. In 1880 the percentage changes in favor of steam to 64.07 per cent, and against water at 35.93 per cent.

Between 1870 and 1880 the total increase of horse-power is 94.948, or 8.92 per cent, while that of steam rises some 969,747 horse-power, or 91.08 per cent. The artificial motor has already distanced the natural, and is leaving it among the dark ages behind us. Industries are always seeking the source of power as an invariable tendency which is as true in the experience of men, as gravitation in the exact sciences.

The following table exhibits the horse-power by states and territories in 1870 and 1880, and their relative rank in total power:

| STATES AND TERRITORIES. | Rank in 1880. | Horse-Power in 1880. | Rank in 1870. | Hoise-Power in 1870. |
|---|---|---|---|---|
| Pennsylvania | 1 | 512,408 | 1 | 363,918 |
| New York | 2 | 454,143 | 2 | 334,363 |
| Massachusetts | 3 | 309,759 | 3 | 184,356 |
| Ohio | 4 | 261,143 | 4 | 174,323 |
| Michigan | 5 | 164,747 | 5 | 105,851 |
| Illinois | 6 | 144,288 | 7 | 86,044 |
| Indiana | 7 | 131,770 | 6 | 100,369 |
| Connecticut | 8 | 118,232 | 8 | 80,374 |
| Wisconsin | 9 | 106,085 | 11 | 64,223 |
| Maine | 10 | 100,476 | 9 | 79,573 |
| New Jersey | 11 | 99,858 | 12 | 58,139 |
| New Hampshire | 12 | 87,750 | 10 | 77,078 |
| Missouri | 13 | 80,749 | 13 | 55,062 |
| Rhode Island | 14 | 63,575 | 16 | 42.027 |
| Vermont | 15 | 63.314 | 14 | 51,322 |
| Virginia | 16 | 57,174 | 15 | 49,612 |
| Kentucky | 17 | 54,929 | 17 | 39,568 |
| Iowa | 18 | 54,221 | 18 | 39,547 |
| Minnesota | 19 | 53,880 | 26 | 20.139 |
| Tennessee | 20 | 51,952 | 20 | 37,981 |
| Maryland | 21 | 51,259 | 22 | 32,422 |
| Georgia | 22 | 51,169 | 19 | 38,243 |
| North Carolina | 23 | 45,088 | 21 | 33,152 |
| West Virginia | 24 | 37,910 | 23 | 27,331 |
| California | 25 | 32,921 | 24 | 25,370 |
| Texas | 26 | 30,534 | 29 | 13,044 |
| Alabama | 27 | 27,576 | 27 | 18,751 |
| South Carolina | 28 | 25,868 | 28 | 14,932 |
| Kansas | 29 | 21,079 | 34 | 8,149 |
| Mississippi | 30 | 18,450 | 30 | 12,472 |
| Arkansas | 31 | 15,733 | 35 | 7,646 |
| Delaware | 32 | 15,428 | 32 | 8,533 |
| Oregon | 33 | 13,589 | 33 | 8,277 |
| Louisiana | 34 | 11,346 | 25 | 25,066 |
| Nebraska | 35 | 8,494 | 37 | 3,311 |
| Florida | 36 | 7,147 | 36 | 3,700 |
| Colorado | 37 | 5,802 | 40 | 2,225 |
| Utah | 38 | 4,689 | 39 | 2,500 |
| Washington | 39 | 4,395 | 38 | 2,823 |
| District of Columbia | 40 | 3.143 | 41 | 1,889 |
| Dakota | 41 | 2,224 | 46 | 324 |
| Idaho | 42 | 1,682 | 44 | 606 |
| Montana | 43 | 1,498 | 42 | 1,617 |
| New Mexico | 44 | 1,359 | 43 | 911 |
| Wyoming | 45 | 755 | 45 | 344 |
| Nevada | 46 | 716 | 31 | 8,545 |
| Arizona | 47 | 530 | 47 | 90 |

Pennsylvania leads. It is the power State. Coal, oil, and gas have contributed to her eminent position. Nothing can rob her of her prestige. Her destiny is very great.

The Lackawanna Valley takes its rank as being above the highest average of 30 horse-power to the square mile. The greatest "density of power" is here and will remain. Steam represents the dominent factor of power of the day, and the steam-boiler enumeration gives rank to states and territories.

The table of boilers is interesting and is presented with the rank of the states in which they are situated.

| STATES AND TERRITORIES. | Rank in 1880. | No. Boilers, 1880. | Horse p'r (Steam) used to manufacture Iron and Steel, 1880. | Rank, etc. |
|---|---|---|---|---|
| Pennsylvania | 1 | 12,095 | 201,282 | 1 |
| New York | 2 | 8,101 | 29,847 | 3 |
| Ohio | 3 | 7,081 | 50,970 | 2 |
| Massachusetts | 4 | 5,105 | 15,471 | 5 |
| Illinois | 5 | 4,143 | 17,852 | 4 |
| Michigan | 6 | 4,109 | 5,240 | 12 |
| Indiana | 7 | 3,889 | 4,495 | 14 |
| Missouri | 8 | 2,448 | 5,915 | 11 |
| New Jersey | 9 | 2,253 | 14,938 | 6 |
| Wisconsin | 10 | 1,879 | 4,600 | 13 |
| Connecticut | 11 | 1,670 | 3.063 | 15 |
| Kentucky | 12 | 1,636 | 6,400 | 8 |
| Iowa | 13 | 1,229 | ...... | .. |
| Texas | 13 | 1,229 | 60 | 32 |
| Maryland | 14 | 1,202 | 5.946 | 10 |
| Rhode Island | 15 | 1,164 | 420 | 24 |
| Tennessee | 16 | 1.074 | 6,045 | 9 |
| California | 17 | 990 | 600 | 22 |
| Virginia | 18 | 962 | 375 | 25 |
| Georgia | 19 | 948 | 1,599 | 20 |
| West Virginia | 20 | 934 | 8,600 | 7 |
| Minnesota | 21 | 960 | ...... | .. |
| Maine | 22 | 747 | 1,885 | 19 |
| North Carolina | 23 | 699 | 253 | 29 |
| Mississippi | 24 | 676 | ...... | .. |
| Alabama | 25 | 616 | 2,400 | 17 |
| New Hampshire | 26 | 598 | 755 | 21 |
| South Carolina | 27 | 592 | ...... | .. |
| Arkansas | 28 | 555 | ...... | .. |
| Louisiana | 29 | 491 | ...... | .. |
| Kansas | 30 | 426 | 1,900 | 18 |
| Vermont | 31 | 378 | 350 | 26 |
| Delaware | 32 | 365 | 2,559 | 16 |
| Florida | 33 | 291 | ...... | .. |
| Oregon | 34 | 196 | 147 | 30 |
| Colorado | 35 | 158 | 315 | 27 |
| Nebraska | 36 | 128 | 300 | 28 |
| District of Columbia | 37 | 127 | 135 | 31 |
| Washington | 38 | 96 | ...... | .. |
| Dakota | 39 | 56 | ...... | .. |
| Utah | 40 | 55 | ...... | .. |
| Montana | 41 | 31 | ...... | .. |
| Nevada | 42 | 27 | ...... | .. |
| Idaho | 43 | 23 | ...... | . |
| New Mexico | 44 | 19 | | .. |
| Wyoming | 45 | 18 | 455 | 23 |
| Arizona | 46 | 15 | ...... | |

The eloquence of these figures leaves little to be added. The logical facts defy controversy.

## THE CHANGE FROM STEAM TO GAS.

Every indication of the growth of devices and of power is that the steam-engine is doomed, and that the steam-boiler must give way to the gas-producer. This eventful day will make possible a vast revolution, and the gas-engine in the household may become as common as the cooking-stove or the sewing machine. When motors can, as they will, be made simple and inexpensive, they must become a necessity in house and barn as well as in factory and shop. The percentage of applied artificial power must become very vast to what it is to-day. And it may, perhaps, solve some of the industrial and social problems which are now fretting the lives and worrying the very existence of men. The huge factory has taken the place of household industry,—by sheer force of competition,—a mere question of the influence of artificial power. If the spread of power under the contemplated régime is justified to the hope, we shall certainly see the factory system decline before its lively competitor in every household. In face of the discouragements and agitations of the past few years, and despairing of a competent solution on the present basis, there are few who would not glory in the domination of Home-working over that of Factory-working. Motors that can be managed as gas-lighting can, by the simple turn of the lever, unattended by danger and being comparatively inexpensive, will put into the hands of individuals a source of life-work not now possible. This solution a universal gas fuel and the substitution of the gas-engine may accomplish; and we may have the merry, happy contented worker of the future, in place of so much of unwilling toil, as of the present day.

---

## LOCATION AND RAILROAD FACILITIES.

The city of Scranton is situate 145 miles from New York and 167 miles from Philadelphia, and upon the great railway lines to the West. It has already become a railway center; the following eminent organizations have terminals here: The Delaware, Lackawanna & Western; The Erie Railway; The Philadelphia & Reading Railway; and the Delaware & Hudson Railroad and Canal Company. The Lehigh Valley and the Pennsylvania system reach within nine miles of the city, and are soon to enter within the limits. The shipping facilities to all points of the compass will challenge criticism.

# CITY POPULATION.

The first white man entered the Lackawanna Valley in 1742, according to the earlier statements; 100 years later there was little but a name, and in 1850 there was no mention of incorporation. The first appearance of importance is in 1860.

| | |
|---|---|
| Population in 1860, | 9,223 |
| " " 1870, | 35,092 |
| " " 1880, | 45,850 |
| " " 1881, | 48,672 |
| " " 1882, | 55,978 |
| " " 1883, | 62,872 |
| " " 1884, | 66,976 |
| " " 1885, | 70,350 |

The population following the year 1880 is computed upon the basis of the census of 1880, and the recorded directory names of that year. While this system is not mathematically correct, yet it may be relied upon as approximating the actual population. The census and directory year of 1880 gave 4⅓ individuals to the directory name; and upon this basis the subsequent calculations are conducted. The growth in population is certainly unsurpassed east of the Mississippi.

---

# SHIPPING STATISTICS.

The statements herewith presented, exhibiting the quarterly receipts and disbursements of produce, etc., will afford some evidence of the growth of the city and locality. The amount of business transacted is assuming volume rapidly.

Quarter-year statement, showing principal articles received and shipped during the past seven complete periods or quarters.

MOVEMENT OF PRODUCE FOR THE QUARTER ENDING SEPTEMBER 30, 1882.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 24,223 | 11,280 |
| Oats, bushels | 60,136 | 29,314 |
| Corn, bushels | 111,746 | 38,858 |
| Wheat, bushels | 7,610 | 5,390 |
| Barley, bushels | 247 | |
| Rye, bushels | 12,991 | 6,830 |
| Feed, tons | 426 | 305 |
| Dressed meat, lbs | 522,600 | 175,400 |
| Pork, bbls | 2,061 | 2,303 |
| Lard, tubs | 5,239 | 1,026 |

| | | |
|---|---|---|
| Butter, tubs | 4,045 | 881 |
| Cheese, boxes | 4,816 | 1,042 |
| Eggs, dozens | 188,028 | 11,800 |
| Liquor, bbls | 544 | 129 |
| Ales and beer, bbls | .... | .... |
| Syrup and molasses, bbls | 230 | 20 |
| Sugar, bbls | 2,564 | 351 |
| Crackers, bbls | 859 | 1,917 |
| Salt, bbls | 941 | 225 |
| Fish, bbls | .... | .... |
| Lime and cement, bbls | 19,735 | 1,955 |
| Oils, bbls | 6,027 | 1,218 |
| Hay, tons | 1,906 | 1,472 |
| Lumber, feet | 7,912,000 | 1,468,000 |
| Iron ore and lime stone, tons | 59,367 | 794 |
| Pig iron, tons | 20,335 | 228 |
| Other iron, tons | 7,865 | 5,063 |
| Steel rails, tons | 3,542 | 29,538 |
| Coal, tons | 7,597 | 1,700,602 |
| Merchandise, lbs | 6,768,031 | 3,567,963 |
| Miscellaneous mdse., lbs | 23,051,635 | 14,669,481 |
| Cattle, head | 783 | 23 |
| Sheep, head | 88 | 2 |
| Hogs, head | .... | .... |
| Mules, head | 105 | .... |
| Horses, head | 76 | 34 |
| Silk, lbs | 20,385 | 18,650 |

MOVEMENT OF MERCHANDISE FOR THE QUARTER ENDING DECEMBER 31, 1882.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 27,329 | 5,263 |
| Oats, bushels | 56,952 | 14,680 |
| Corn bushels | 117,763 | 17,419 |
| Wheat, bushels | 6,849 | .... |
| Barley, bushels | 592 | 300 |
| Rye, bushels | 11,547 | 2,919 |
| Feed, tons | 547 | 746 |
| Dressed meat, lbs | 324,000 | 38,600 |
| Pork, bbls | 774 | 1,135 |
| Lard, tubs | 4,326 | 1,614 |
| Butter, tubs | 7,324 | 1,591 |
| Cheese, boxes | 5,924 | 2,674 |
| Eggs, dozens | 139,103 | 36,175 |
| Liquor, bbls | 1,869 | 203 |
| Ales and beer, bbls | .... | .... |
| Syrup and molasses, bbls | 391 | 25 |
| Sugar, bbls | 2,865 | 367 |
| Crackers, bbls | 1,195 | 3,104 |
| Salt, bbls | 2,761 | 522 |
| Fish, bbls | .... | .... |
| Lime and cement, bbls | 11,935 | 1,350 |

| | | |
|---|---|---|
| Oils, bbls | 8,571 | 2,054 |
| Hay, tons | 2,316 | 531 |
| Lumber, feet | 9,666,000 | 1,373,000 |
| Iron ore and lime stone, tons | 50,471 | 764 |
| Pig iron, tons | 10,688 | 429 |
| Other iron, tons | 5,014 | 4,068 |
| Steel rails, tons | 1,411 | 15,433 |
| Coal, tons | 5,667 | 3,893,352 |
| Merchandise, lbs | 9,129,406 | 2,077,241 |
| Miscellaneous mdse., lbs | 26,625,783 | 8,585,613 |
| Cattle, head | 1,022 | 6 |
| Sheep, head | 226 | 29 |
| Hogs, head | 3,666 | .... |
| Mules, head | 123 | 12 |
| Horses, head | 32 | 15 |
| Silk, lbs | 18,940 | 22,030 |

Movement of Merchandise for the Quarter Ending March 31, 1883.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 22,822 | 4,673 |
| Oats, bushels | 48,231 | 7,436 |
| Corn, bushels | 85,826 | 23,247 |
| Wheat, bushels | 6,904 | 411 |
| Barley, bushels | 1,052 | 1,854 |
| Rye, bushels | 443 | 443 |
| Feed, tons | 520 | 498 |
| Dressed meat, lbs | 5,715,900 | 136,867 |
| Pork, bbls | 1,195 | 1,610 |
| Lard, tubs | 25,041 | 1,824 |
| Butter, tubs | 4,442 | 1,487 |
| Cheese, boxes | 2,152 | 1,469 |
| Eggs, dozens | 102,998 | 21,935 |
| Liquor, bbls | 1,120 | 151 |
| Ales and beer, bbls | .... | .... |
| Syrup and molasses, bbls | 391 | 65 |
| Sugar, bbls | 2,701 | 348 |
| Crackers, bbls | 1,071 | 3,039 |
| Salt, bbls | 1,541 | 321 |
| Fish, bbls | .... | .... |
| Lime and cement, bbls | 7,774 | 986 |
| Oils, bbls | 7,558 | 1,447 |
| Hay, tons | 1,722 | 398 |
| Lumber, feet | 6,157,000 | 1,254,000 |
| Iron ore and lime stone, tons | 34,610 | .... |
| Pig iron, tons | 15,285 | 128 |
| Other iron, tons | 3,000 | 3,559 |
| Steel rails, tons | 532 | 23,202 |
| Coal, tons | 1,116 | 1,991,784 |
| Merchandise, lbs | 7,663,214 | 1,637,474 |
| Miscellaneous mdse., lbs | 17,826,071 | 14,585,363 |
| Cattle, head | 989 | 2 |

| | | |
|---|---|---|
| Sheep, head | 414 | 3 |
| Hogs, head | 4,075 | .... |
| Mules, head | 89 | 45 |
| Horses, head | 27 | 8 |
| Silk, lbs | 26,962 | 28,403 |

MOVEMENT OF MERCHANDISE FOR THE QUARTER ENDING JUNE 30, 1883.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 25,180 | 4,021 |
| Oats, bushels | 72,976 | 15,964 |
| Corn, bushels | 70,606 | 22,120 |
| Wheat, bushels | 2,465 | ...... |
| Barley, bushels | 727 | 10 |
| Rye, bushels | ...... | ...... |
| Feed, tons | 521 | 128 |
| Dressed meat, lbs | 1,198,437 | 70,153 |
| Pork, bbls | 2,010 | 1,853 |
| Lard, tubs | 4,497 | 1,531 |
| Butter, tubs | 5,733 | 1,202 |
| Cheese, boxes | 3,813 | 1,170 |
| Eggs, dozens | 331,400 | 33,390 |
| Liquor, bbls | 1,155 | 236 |
| Ales and beer, bbls | ...... | ...... |
| Syrup and molasses, bbls | 229 | 38 |
| Sugar, bbls | 2,615 | 426 |
| Crackers, bbls | 712 | 2,686 |
| Salt, bbls | 1,728 | 381 |
| Fish, bbls | ...... | ...... |
| Lime and cement, bbls | 16,277 | 1,664 |
| Oils, bbls | 5,746 | 1,276 |
| Hay, tons | 840 | 154 |
| Lumber, feet | 8,126,000 | 446,000 |
| Iron ore and lime stone, tons | 48,356 | ...... |
| Pig iron, tons | 24,055 | ...... |
| Other iron, tons | 3,884 | 1,347 |
| Steel rails, tons | 194 | 38,435 |
| Coal, tons | 2,193 | 3,168,731 |
| Merchandise, lbs | 9,331,110 | 2,178,239 |
| Miscellaneous mdse, lbs | 18,366,321 | 17,916,192 |
| Cattle, head | 1,415 | .. ... |
| Sheep, head | 1,478 | ...... |
| Hogs, head | 205 | ...... |
| Mules, head | 157 | 12 |
| Horses, head | 245 | 44 |
| Silk, lbs | 33,484 | 29,074 |

MOVEMENT OF MERCHANDISE FOR THE QUARTER ENDING SEPTEMBER 30, 1883.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 23,835 | 3,733 |
| Oats, bushels | 47,308 | 18,976 |
| Corn, bushels | 106,544 | 37,286 |

| | | |
|---|---|---|
| Wheat, bushels | ...... | 4 |
| Barley, bushels | 1,351 | ...... |
| Rye, bushels | ...... | ...... |
| Feed, tons | 526 | 197 |
| Dressed meat, lbs | 1,988,090 | 131,756 |
| Pork, bbls | 1,406 | 2,083 |
| Lard, tubs | 3,764 | 1,885 |
| Butter, tubs | 4,885 | 1,431 |
| Cheese, boxes | 5,374 | 1,117 |
| Eggs, dozens | 248,415 | 32,360 |
| Liquors, bbls | 1,044 | 137 |
| Ales and beer, bbls | ...... | ...... |
| Syrup and molasses, bbls | 229 | 32 |
| Sugar, bbls | 4,111 | 595 |
| Crackers, bbls | 1,102 | 2,496 |
| Salt, bbls | 4,971 | 1,382 |
| Fish, bbls | ...... | ...... |
| Lime and cement, bbls | 17,051 | 1,823 |
| Oils, bbls | 9,390 | 2,475 |
| Hay, tons | 445 | 271 |
| Lumber, feet | 11,866,000 | 553,000 |
| Iron ore and lime stone, tons | 71,448 | ...... |
| Pig iron, tons | 27,634 | ...... |
| Other iron, tons | 4,247 | 1,893 |
| Steel rails, tons | 104 | 36,780 |
| Coal, tons | 1,299 | 3,002,179 |
| Merchandise, lbs | 26,621,884 | 1,812,465 |
| Miscellaneous mdse., lbs | 22,591,864 | 1,924,203 |
| Cattle, head | 881 | ...... |
| Sheep, head | 558 | 15 |
| Hogs, head | 15 | ...... |
| Mules, head | 122 | ...... |
| Horses, head | 115 | 38 |
| Silk, lbs | 7,472 | 11,568 |

Movement of Merchandise for the Quarter Ending December 31, 1883.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 31,430 | 3,887 |
| Oats, bushels | 108,141 | 11,195 |
| Corn, bushels | 129,483 | 55,419 |
| Wheat, bushels | 3,469 | ...... |
| Barley, bushels | 2,382 | ...... |
| Rye, bushels | ...... | ...... |
| Feed, tons | 623 | 247 |
| Dressed meat, lbs | 1,755,525 | 145,059 |
| Pork, bbls | 1,224 | 1,561 |
| Lard, tubs | 5,686 | 2,554 |
| Butter, tubs | 8,546 | 1,921 |
| Cheese, boxes | 7,578 | 1,340 |
| Eggs, dozens | 274,180 | 38,875 |
| Liquor, bbls | 1,410 | 182 |

| | | |
|---|---|---|
| Ales and beer, bbls | ...... | ...... |
| Syrup and molasses, bbls | 376 | 29 |
| Sugar, bbls | 3,285 | 406 |
| Crackers, bbls | 1,358 | 3,521 |
| Salt, bbls | 3,019 | 615 |
| Fish, bbls | ...... | .... |
| Lime and cement, bbls | 18,600 | 1,486 |
| Oils, bbls | 9,298 | 2,141 |
| Hay, tons | 1,660 | 176 |
| Lumber, feet | 30,653,945 | 2,347,053 |
| Iron ore and lime stone | 42,501 | ...... |
| Pig iron, tons | 19,599 | 34 |
| Other iron, tons | 4,075 | 1,619 |
| Steel rails, tons | 10 | 33,542 |
| Coal, tons | 2,425 | 1,083,079 |
| Merchandise, lbs | 12,019,782 | 2,174,880 |
| Miscellaneous mdse., lbs | 16,921,664 | 12,047,527 |
| Cattle, head | 667 | ...... |
| Sheep, head | 19 | ...... |
| Hogs, head | 5,423 | ...... |
| Mules, head | 123 | 3 |
| Horses, head | 75 | 24 |

MOVEMENT OF MERCHANDISE FOR THE YEAR ENDING DECEMBER 31, 1883.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 104.321 | 16,214 |
| Oats, bushels | 266,656 | 53,569 |
| Corn, bushels | 396,608 | 142,031 |
| Wheat, bushels | 12,938 | 44 |
| Barley, bushels | 5,530 | 1,864 |
| Rye, bushels | 443 | 443 |
| Feed, tons | 2,189 | 1,663 |
| Dressed meat, lbs | 10,656,952 | 392,535 |
| Pork, bbls | 5,835 | 7,207 |
| Lard, tubs | 16,551 | 7,794 |
| Butter, tubs | 23,606 | 6,041 |
| Cheese, boxes | 17,919 | 5,195 |
| Eggs, dozens | 867,004 | 126,560 |
| Liquor bbls | 4,729 | 706 |
| Ales and beer, bbls, included in miscellaneous mdse | ...... | ...... |
| Syrup and molasses, bbls | 1,225 | 194 |
| Sugar, bbls | 3,822 | 1,775 |
| Crackers, bbls | 4,243 | 11,943 |
| Salt, bbls | 10,226 | 2,699 |
| Fish, bbls, included in miscellaneous merchandise | ...... | ...... |
| Lime and cement, bbls | 59.702 | 5.059 |
| Oils, bbls | 29,265 | 6,893 |
| Hay, tons | 4,667 | 999 |
| Lumber, feet | 56,802,946 | 4,560,053 |
| Iron ore and lime stone, tons | 196,915 | ...... |
| Pig iron, tons | 86,493 | 162 |

| | | |
|---|---|---|
| Other iron, tons | 15,206 | 8,418 |
| Steel rails, tons | 850 | 131,909 |
| Coal, tons | 6,933 | 2,948,844 |
| Merchandise, lbs | 56,635,990 | 7,803,054 |
| Miscellaneous mdse., lbs | 72,973,843 | 63,331 056 |
| Cattle, head | 3,932 | 2 |
| Sheep, head | 2,597 | 18 |
| Hogs, head | 9,618 | ...... |
| Mules, head | 463 | 2 |
| Horses, head | 22 | 18 |
| Silk, lbs | 67,918 | 69,045 |

Movement of Merchandise for the Quarter Ending March 31, 1884.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 21,119 | 5,802 |
| Oats, bushels | 54,841 | 8,851 |
| Corn, bushels | 94,673 | 22,644 |
| Wheat, bushels | 14,167 | 478 |
| Barley, bushels | 11,541 | 1,857 |
| Rye, bushels | 886 | 886 |
| Feed, tons | 423 | 946 |
| Dressed meat, lbs | 1,653,588 | 473,319 |
| Pork, bbls | 208 | 905 |
| Lard, tubs | 1,364 | 1,328 |
| Butter, tubs | 4,154 | 1,758 |
| Cheese, boxes | 2,426 | 1,208 |
| Eggs, dozens | 67,861 | 12,301 |
| Liquor, bbls | 1,185 | 155 |
| Ales and beer, bbls | 2,556 | 183 |
| Syrup and molasses, bbls | 367 | 57 |
| Sugar, bbls | 3,489 | 395 |
| Crackers, bbls | 1,206 | 2,876 |
| Salt, bbls | 1,072 | 316 |
| Fish, bbls | 447 | 154 |
| Lime and cement, bbls | 10,003 | 494 |
| Oils, bbls | 6,670 | 1,669 |
| Hay, tons | 2,582 | 322 |
| Lumber, feet | 47,531,903 | 505,044 |
| Iron ore and lime stone, tons | 34,535 | ...... |
| Pig iron, tons | 20,174 | 106 |
| Other iron, tons | 113,244 | 1,408 |
| Steel rails, tons | 85 | 55,649 |
| Coal, tons | ...... | 1,307,557 |
| Merchandise, lbs | 8,532,869 | 1,219,712 |
| Miscellaneous mdse., lbs | 19,528,201 | 11,574,958 |
| Cattle, head | 442 | 1 |
| Sheep, head | 1,080 | ...... |
| Hogs, head | 5,211 | ..... |
| Mules, head | 97 | 58 |
| Horses, head | 139 | 17 |
| Silk, lbs | 19,732 | ..... |

Movement of Produce for the Quarter Ending June 30, 1884.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 29,194 | 7,436 |
| Oats, bushels | 101,814 | 31,741 |
| Corn, bushels | 114,881 | 67,163 |
| Wheat, bushels | 14,070 | 333 |
| Barley, bushels | 17,619 | ...... |
| Rye, bushels | ...... | ...... |
| Feed, tons | 875 | 490 |
| Dressed meat, lbs | 1,763 763 | 187,175 |
| Pork, bbls | 1,252 | 613 |
| Lard, tubs | 1,239 | 1,617 |
| Butter, tubs | 4,273 | 2,115 |
| Cheese, boxes | 7,310 | 1,325 |
| Eggs, dozens | 355,717 | 86,048 |
| Liquor, bbls | 1,119 | 256 |
| Ales and Beer, bbls | 6,576 | 1,489 |
| Syrup and molasses, bbls | 246 | 45 |
| Sugar, bbls | 3,884 | 432 |
| Crackers, bbls | 1,469 | 2,907 |
| Salt, bbls | 947 | 326 |
| Fish, bbls | 1,006 | 179 |
| Lime and cement, bbls | 28,317 | 3,364 |
| Oils, bbls | 5,415 | 1,956 |
| Hay, tons | 1,877 | 1,427 |
| Lumber, feet | 20,744,394 | 4,229,824 |
| Iron ore and lime stone, tons | 40,467 | 146 |
| Pig iron, tons | 29,082 | ...... |
| Other iron, tons | 10,929 | 44,565 |
| Steel rails, tons | 1,161 | 53,815 |
| Coal, tons | 2,158 | 981,103 |
| Merchandise, lbs | 818,859 | 4,341,499 |
| Miscellaneous mdse., lbs | 17,243,083 | 1,414,059 |
| Cattle, head | 1,138 | 237 |
| Sheep, head | 1,115 | ...... |
| Hogs, head | 243 | ...... |
| Mules, head | 69 | 4 |
| Horses, head | 140 | 87 |
| Spiegle, tons | 450 | ...... |
| Fruit and Vegetables, lbs | 303,170 | ...... |

Movement of Produce for the Quarter Ending September 31, 1884

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 27,787 | 8,108 |
| Oats, bushels | 107,929 | 27,984 |
| Corn, bushels | 163,939 | 69,620 |
| Wheat, bushels | 18,773 | .... |
| Barley, bushels | 11,927 | .... |
| Rye, bushels | ¾ | .... |
| Feed, tons | 326 | 306 |
| Dressed meat, lbs | 964,437 | 144,259 |

| | | |
|---|---|---|
| Pork, bbls | 3,149 | 794 |
| Lard, tubs | 4,399 | 1,614 |
| Butter, tubs | 4,346 | 1,378 |
| Cheese, boxes | 5,701 | 1,566 |
| Eggs, dozens | 249,813 | 42,402 |
| Liquor, bbls | 1,004 | 356 |
| Ales and beer, bbls | 4,535 | 1,220 |
| Syrup and molasses, bbls | 273 | 32 |
| Sugar, bbls | 4,549 | 656 |
| Crackers, bbls | 2,086 | 3,417 |
| Salt, bbls | 2,473 | 763 |
| Fish, bbls | 678 | 176 |
| Lime and cement, bbls | 20,209 | 2,057 |
| Oils, bbls | 7,923 | 2,065 |
| Hay, tons | 1,070 | 331¾ |
| Lumber, feet | 16,347,696 | 10,225,621 |
| Iron ore and lime stone, tons | 53,317 | 68 |
| Pig iron, tons | 26,862 | 53 |
| Other iron, tons | 5,928 | 2,242 |
| Steel rails, tons | 148 | 46,299 |
| Coal, tons | 3,245 | .... |
| Merchandise, lbs | 7,895,167 | 2,349,166 |
| Miscellaneous mdse., lbs | 20,057,095 | 11,122,233 |
| Cattle, head | 631 | .... |
| Sheep, head | 146 | .... |
| Hogs, head | 232 | .... |
| Mules, head | 91 | 13 |
| Horses, head | 153 | 62 |
| Fire brick and clay, tons | 500½ | .... |
| Speigle | 1,459¾ | .... |
| Vegetables and fruits, lbs | 192,185 | .... |
| Peaches, baskets | 8,664 | .... |
| Vinegar, bbls | .... | 30 |

MOVEMENT OF PRODUCE FOR THE QUARTER ENDING DECEMBER 31, 1884.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 30,235 | 8,229 |
| Oats, bushels | 105,329 | 17,598 |
| Corn, bushels | 144,343 | 65,709 |
| Wheat, bushels | 23,280 | 954 |
| Barley, bushels | 10,793 | .... |
| Rye, bushels | .... | .... |
| Feed, tons | 945 | 237 |
| Dressed meat, lbs | 1,177,810 | 158,455 |
| Pork, bbls | 2,998 | 831 |
| Lard, tubs | 3,610 | 1,495 |
| Butter, tubs | 7,239 | 1,901 |
| Cheese, boxes | 7,034 | 1,826 |
| Eggs, dozens | 252,254 | 39,670 |
| Liquor, bbls | 1,550 | 253 |
| Ales and beer, bbls | 5,053 | 531 |

| | | |
|---|---|---|
| Syrup and molasses, bbls | 644 | 72 |
| Sugar, bbls | 4,341 | 541 |
| Crackers, bbls | 2,565 | 3,096 |
| Salt, bbls | 2,730 | 832 |
| Fish, bbls | 1,909 | 197 |
| Lime and cement, bbls | 12,725 | 791 |
| Oils, bbls | 9,630 | 2,100 |
| Hay, tons | 3,601 | 592 |
| Lumber, feet | 21,700,924 | 2,731,963 |
| Iron ore and lime stone, tons | 41,081 | 3,847 |
| Pig iron, tons | 28,846 | 328 |
| Other iron, tons | 4,116 | 2,123 |
| Steel rails, tons | 500 | 42,612 |
| Coal, tons | 3,767 | 10 |
| Merchandise, lbs | 10,346,429 | 2,284,298 |
| Miscellaneous mdse., lbs | 22,620,463 | 13,963,360 |
| Cattle, head | 319 | 61 |
| Sheep, head | 103 | .... |
| Hogs, head | 4,347 | .... |
| Mules, head | 66 | .... |
| Horses, head | 93 | 29 |
| Spiegle | 2,050 | .... |
| Vinegar, bbls | 193 | 41 |
| Ice, tons | 391 | .... |
| Fire brick and clay, tons | 973 | .... |

MOVEMENT OF PRODUCE FOR THE YEAR ENDING DECEMBER 31, 1884.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 106,715 | 29,675 |
| Oats, bushels | 359,553 | 85,168 |
| Corn, bushels | 617,826 | 215,216 |
| Wheat, bushels | 62,298 | 1,765 |
| Barley, bushels | 51,880 | 1,857 |
| Rye, bushels | ...... | 868 |
| Feed, tons | 2,561 | 1,979 |
| Dressed meat, lbs | 5,669,708 | 964,203 |
| Pork, bbls | 7,617 | 3,154 |
| Lard, tubs | 11,612 | 6,046 |
| Butter, tubs | 20,022 | 7,172 |
| Cheese, boxes | 22,781 | 5,917 |
| Eggs, dozens | 927,471 | 180,422 |
| Liquor, bbls | 4,947 | 1,015 |
| Ales and beer, bbls | 18,220 | 3,463 |
| Syrup and molasses, bbls | 1,428 | 206 |
| Sugar, bbls | 16,263 | 2,023 |
| Crackers, bbls | 7,326 | 12,306 |
| Salt, bbls | 6,333 | 2,237 |
| Fish, bbls | 4,030 | 711 |
| Lime and cement, bbls | 62,554 | 7,706 |
| Oils, bbls | 29,426 | 7,310 |
| Hay, tons | 8,110 | 2,673 |

| | | |
|---|---|---|
| Lumber, feet | 49,147,917 | 17,694,452 |
| Iron ore and lime stone, tons | 154,741 | 4,081 |
| Pig iron, tons | 97,869 | 462 |
| Other iron, tons | 144,232 | 50,411 |
| Steel rails, tons | 1,880 | 197,425 |
| Coal, tons | 10,027 | 1,720,475 |
| Merchandise, lbs | 34,672,974 | 10,093,625 |
| Miscellaneous mdse., lbs | 79,458,942 | 55,089,670 |
| Cattle, head | 2,383 | 456 |
| Sheep, head | 2,444 | ...... |
| Hogs, head | 9,933 | ...... |
| Mules, head | 364 | 97 |
| Horses, head | 465 | 195 |
| Spiegle | 3,959 | ..... |
| Fruit | 3,541,105 | ...... |
| Fire brick and clay, tons | 1,628 | ...... |
| Ice | 355 | ...... |
| Vinegar, bbls | 193 | 111 |
| Peaches, bushels | 8,664 | ...... |
| Apples, bbls | 7,026 | ... .. |

MOVEMENT OF PRODUCE FOR THE QUARTER ENDING MARCH 31, 1885.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 29,076 | 8,645 |
| Oats, bushels | 79,897 | 13,010 |
| Corn, bushels | 134,106 | 176,142 |
| Wheat, bushels | 16,431 | 1,033 |
| Barley, bushels | 11,041 | ...... |
| Rye, bushes | ..... | ...... |
| Feed, tons | 415½ | 297 |
| Dressed meat, lbs | 1,375,239 | 238,240 |
| Pork, bbls | 1,757 | 643 |
| Lard, tubs | 3,787 | 2,020 |
| Butter, tubs | 8,062 | 2,032 |
| Cheese, boxes | 3,597 | 1,000 |
| Eggs, dozens | 172,463 | 30,246 |
| Liquor, bbls | 1,078 | 228 |
| Ales and beer, bbls | 3,974 | 304 |
| Syrup and molasses, bbls | 399 | 91 |
| Sugar, bbls | 3,927 | 652 |
| Crackers, bbls | 2,842 | 1,683 |
| Salt, bbls | 1,589 | 239 |
| Fish, bbls | 2,191 | 434 |
| Lime and cement, bbls | 7,299 | 977 |
| Oils, bbls | 6,938 | 1,633 |
| Hay, tons | 2,280 | 660 |
| Lumber, feet | 10,997,692 | 1,849,083 |
| Iron ore and lime stone, tons | 50,393 | 77 |
| Pig iron, tons | 19,516 | 348 |
| Other iron, tons | 1,797 | 1,428 |
| Steel rails, tons | 77 | 38,006 |

| | | |
|---|---|---|
| Coal, tons | 2,668 | ...... |
| Merchandise, lbs | 6,721,460 | 1,721,883 |
| Miscellaneous mdse | 11,591,320 | 7.234,244 |
| Cattle, head | 327 | ...... |
| Sheep, head | 110 | ...... |
| Hogs, head | 5,509 | ...... |
| Mules, head | 18 | 9 |
| Horses, head | 88 | 6 |
| Spiegle | 1,589 | ...... |
| Fire brick and clay, tons | 449,596 | ...... |
| Vinegar, bbls | 3,916 | 124 |

MOVEMENT OF PRODUCE FOR THE QUARTER ENDING JUNE 30, 1885.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 17,075 | 4,867 |
| Oats, bushels | 97,024 | 23,236 |
| Corn, bushels | 94,950 | 50,644 |
| Wheat, bushels | 15,937 | 1,089 |
| Barley, bushels | 19,531 | ...... |
| Rye, bushels | ...... | ...... |
| Feed, tons | 477 | 304 |
| Dressed meat, lbs | 1,544,309 | 184,532 |
| Pork, bbls | 2,663 | 614 |
| Lard, tubs | 1,969 | 1,555 |
| Butter, tubs | 4,325 | 1,743 |
| Cheese, boxes | 3,029 | 1,356 |
| Eggs, dozens | 332,344 | 64,402 |
| Liquor, bbls | 1,137 | 427 |
| Ales and beer, bbls | 2,564 | 442 |
| Syrup and molasses, bbls | 1,645 | 453 |
| Sugar, bbls | 3,743 | 1,158 |
| Crackers, bbls | 2,391 | 1,474 |
| Salt, bbls | 1,578 | 404 |
| Fish, bbls | 6,498 | 484 |
| Lime and cement, bbls | 24,605 | 2,226 |
| Oils, bbls | 4,091 | 1,283 |
| Hay, tons | 1,996½ | 833 |
| Lumber, feet | 17,286,375 | 4,474,991 |
| Iron ore and lime stone, tons | 43,789 | 17 |
| Pig iron, tons | 21,555 | 47 |
| Other iron, tons | 4,999 | 1,445 |
| Steel rails, tons | 138 | 26,847 |
| Coal, tons | 2,062 | 1 |
| Merchandise, lbs | 10,891,041 | 1,241,282 |
| Miscellaneous mdse., lbs | 19,749,348 | 9,095,146 |
| Cattle, head | 321 | 2 |
| Sheep, head | 825 | ...... |
| Hogs, head | 44 | 8 |
| Mules, head | 26 | 5 |
| Horses, head | 62 | 28 |
| Spiegle | 1,097 | ...... |

| | | |
|---|---|---|
| Fire brick and clay, tons | 286 | ...... |
| Stone, carloads | 96 | ...... |
| Vinegar, bbls | 372 | ...... |
| Tallow, bbls | ...... | 158 |

MOVEMENT OF PRODUCE FOR THE QUARTER ENDING SEPTEMBER 30, 1885.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 22,827 | 7,117 |
| Oats, bushels | 100,217 | 23,340 |
| Corn, bushels | 192,340 | 72,827 |
| Wheat, bushels | 14,801 | ...... |
| Barley, bushels | 8,114 | 4,925 |
| Rye, bushels | ...... | ...... |
| Feed, tons | 550½ | 309½ |
| Dressed meat, lbs | 853,143 | 162,552 |
| Pork, bbls | 2,776 | 1,134 |
| Lard, tubs | 5,534 | 1,352 |
| Butter, tubs | 4,613 | 1,449 |
| Cheese, boxes | 7,343 | 1,695 |
| Eggs, dozens | 237,704 | 72,718 |
| Liquor, bbls | 1,048 | 274 |
| Ales and beer, bbls | 4,501 | 1,008 |
| Syrup and molasses, bbls | 327 | 36 |
| Sugar, bbls | 6,412 | 889 |
| Crackers, bbls | 1,890 | 2,306 |
| Salt, bbls | 2,083 | 642 |
| Fish, bbls | 1,321 | 155 |
| Lime and cement, bbls | 22,427 | 1,775 |
| Oils, bbls | 7,745 | 2,004 |
| Hay, tons | 1,090 | 281 |
| Lumber, feet | 6,335,997 | 2,310,868 |
| Iron ore and lime stone, tons | 38,979 | ...... |
| Pig iron, tons | 83,371 | 34 |
| Other iron, tons | 5,263 | 1,494 |
| Steel rails, tons | 41 | 35,512 |
| Coal, tons | 4,641 | 104 |
| Merchandise, lbs | 8,912,596 | 2,683,335 |
| Miscellaneous mdse., lbs. | 13,930,401 | 13,570,860 |
| Cattle, head | 48 | 92 |
| Sheep, head | 421 | 74 |
| Hogs, head | 1 | ...... |
| Mules, head | 70 | 48 |
| Horses, head | 176 | 48 |
| Spiegle, tons | 259 | ...... |
| Vinegar, bbls | 261 | 109 |
| Sand brick and clay, tons | 2,832 | ...... |
| Ice, car loads | 7 | ...... |
| Peaches, baskets | 16,415 | ...... |
| Tallow, bbls | 86 | ...... |
| Malt, bushels | 1,000 | ...... |
| Stone, car loads | 11 | 9 |

MOVEMENT OF PRODUCE FOR THE QUARTER ENDING DECEMBER 31, 1885.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 31,727 | 9,839 |
| Oats, bushels | 125,331 | 23,388 |
| Corn, bushels | 165,380 | 57,763 |
| Wheat, bushels | 18,503 | ...... |
| Barley, bushels | 12,265 | ...... |
| Rye, bushels | ...... | ...... |
| Feed, tons | 482 | 305 |
| Dressed meats, lbs | 1,264,552 | 220,562 |
| Pork, bbls | 3,567 | 953 |
| Lard, tubs | 2,683 | 1,670 |
| Butter, tubs | 7,772 | 2,514 |
| Cheese, boxes | 5,751 | 1,952 |
| Eggs, dozens | 255,855 | 58,538 |
| Liquor, bbls | 1,419 | 278 |
| Ales and beer, bbls | 5,156 | 598 |
| Syrup and molasses, bbls | 504 | 80 |
| Sugar, bbls | 4,751 | 775 |
| Crackers, bbls | 1,921 | 3,040 |
| Salt, bbls | 2,927 | 750 |
| Fish, bbls | 1,969 | 234 |
| Lime and cement, bbls | 14,635 | 1,494 |
| Oils, bbls | 2,660 | 1,100 |
| Hay, tons | 2,660 | 1,109 |
| Lumber, feet | 14,602,871 | 2,473,123 |
| Iron ore and lime stone, tons | 32,667 | 3,847 |
| Pig iron, tons | 34,413 | 257 |
| Other iron, tons | 3,756 | 12,375 |
| Steel rails, tons | 140 | 42,029 |
| Coal, tons | 1,540 | 10 |
| Merchandise, lbs | 7,512,539 | 1,673 062 |
| Miscellaneous mdse., lbs | 57,175,989 | 13,634,557 |
| Cattle, head | 133 | ...... |
| Sheep, head | 94 | ...... |
| Hogs, head | 4,742 | ...... |
| Mules, head | 1,074 | 11 |
| Horses, head | 763 | 16 |
| Spiegle, tons | 2,049 | ...... |
| Vinegar, bbls | 423 | 97 |
| Sand brick and clay, tons | 1,620 | ...... |
| Stone, car loads | 28 | 1 |
| Coke, tons | 6,429 | ...... |

MOVEMENT OF PRODUCE FOR THE YEAR ENDING DECEMBER 31, 1885.

| | Received. | Shipped. |
|---|---|---|
| Flour, bbls | 107,605 | 30,568 |
| Oats, bushels | 403,629 | 82,984 |
| Corn, bushels | 600,461 | 347,596 |
| Wheat, bushels | 66,342 | 2,140 |
| Barley, bushels | 49,940 | 4,925 |

| | | |
|---|---|---|
| Rye, bushels | ...... | ...... |
| Feed, tons | 1,925 | 1,315½ |
| Dressed meat, lbs | 5,038,333 | 792,390 |
| Pork, bbls | 11,563 | 3,335 |
| Lard, tubs | 12,873 | 7,6co |
| Butter, tubs | 25,565 | 7,418 |
| Cheese, boxes | 19,716 | 6,008 |
| Eggs, dozens | 1,137,646 | 227,899 |
| Liquor, bbls | 4,664 | 1,197 |
| Ales and beer, bbls | 16,225 | 2,352 |
| Syrup and molasses, bbls | 2,895 | 675 |
| Sugar, bbls | 18,733 | 3,474 |
| Crackers, bbls | 9,045 | 8,303 |
| Salt, bbls | 8,175 | 235 |
| Fish, bbls | 11,979 | 1,307 |
| Lime and cement, bbls | 68,873 | 6,472 |
| Oils, bbls | 29,844 | 7,600 |
| Hay, tons | 7,526 | 2,853 |
| Lumber, feet | 59,222,945 | 11,117,906 |
| Iron ore and lime stone, tons | 163,168 | 3,941 |
| Pig iron, tons | 148,875 | 697 |
| Other iron, tons | 15,815 | 17,496 |
| Steel rails, tons | 1,141 | 136,562 |
| Coal, tons | 10,270 | 749 |
| Merchandise, lbs | 29,686,636 | 8,320,462 |
| Miscellaneous mdse., lbs | 102,438,008 | 44,453,794 |
| Cattle, head | 728 | 94 |
| Sheep, head | 1,356 | 74 |
| Hogs, head | 10,305 | 9 |
| Mules, head | 1,118 | 25 |
| Horses, head | 1,117 | 121 |
| Peaches, baskets | 16,415 | ...... |
| Stone, car loads | 114 | 1 |
| Vinegar, barrels | 4,972 | 330 |
| Coke, tons | 6,849 | ...... |
| Cid.r, barrels | ...... | 28 |
| Sand, car loads | 956 | 11 |
| Spiegle, tons | 5,289 | ...... |
| Fire brick and clay, tons | 5,023 | ...... |
| Ice, car loads | 9 | ...... |
| Tallow, bbls | 86 | 158 |
| Pipe, car loads | 10 | ...... |
| Malt, bushels | 1,000 | ...... |

## THE INCREASE OF BUILDING.

There has been no census enumeration of the new buildings erected since 1880, in which year the total numbered 7,334, or 6.25 persons to the population. The estimates since are carefully calculated from builders, lumber dealers, and insurance writers, and are substantially correct.

| | | | |
|---|---|---|---|
| Number of buildings, according to last census, 1880, | | | 7,334 |
| " " " | erected in 1881, | | 500 |
| " " " | " " | 1882, | 700 |
| " " " | " " | 1883, | 1,200 |
| " " " | " " | 1884, | 1,250 |
| " " " | " " | 1885, | 1,100 |
| Total to date, | | | 12,084 |

The population being at 70,350, as previously calculated, the number of persons to the building would be 5.82, a decline in the percentage since 1880. This difference is plainly inferable from the fact that separate private residences in the last three years have greatly outnumbered those of combined tenement blocks, and the city has to-day a proportionate better housing for its people.

## BUILDING MATERIAL.

The abundance of supply contained in the mountain sides of the Lackawanna Valley, consisting of conglomerate and sandstone, and the beds of fire and brick-clay that are practically inexhaustible, renders it possible to build at less expense in Scranton than elsewhere. Foundation stone ranges at about one dollar and fifty cents per cubic yard; white sandstone and blue Trenton, capable of infinite ornamental possibilities and structural display, may be had at about two dollars and seventy-five cents; good building brick are covered by eight dollars per thousand. Flagging is correspondingly low in cost, being from 12 to 80 cents per square foot, according to size and thickness. More decided advantages are offered nowhere.

## STATEMENT SHOWING CITY GROWTH IN THE POSTAL DEPARTMENT.

The table herewith presented indicates the steady and uniform growth that is depicted in every enumeration connected with the municipal organization. The table is the best evidence of city progress. Over 50 per cent of increase is noted in the first quarter 1886 over that of 1884. The whole table merits particu lar attention.

| | No. of Carriers. | No. of Delivery Trips Daily. | No. of Collection Trips Daily. | Letters Delivered. | Letters Collected. | Postals Delivered. | Postals Collected. | Newspapers Delivered. | Newspapers Collected. | No. of Pieces Handled. Each quarter. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1883. | | | | | | | | | | |
| Nov., | 10 | 18 | 28 | 40,514 | 38,665 | 8,992 | 8,955 | 26,755 | 5,724 | |
| Dec. | 10 | 18 | 28 | 48,216 | 41,541 | 7,835 | 7.816 | 32,591 | 2,990 | |
| | | | | 88.730 | 80,206 | 16,827 | 16,771 | 59.346 | 8,714 | 270,594 |
| 1884. | | | | | | | | | | |
| Jan., | 11 | 23 | 32 | 57,608 | 45,261 | 10,145 | 8,645 | 40,960 | 2,864 | |
| Feb., | 11 | 23 | 32 | 59,972 | 43,880 | 10,216 | 7,344 | 44,481 | 3,073 | |
| March, | 11 | 23 | 32 | 61,198 | 46.580 | 11,923 | 8,476 | 51,220 | 6.879 | |
| | | | | 178,778 | 135.721 | 32,284 | 24,465 | 136,661 | 12,816 | 520,725 |
| April, | 11 | 24 | 37 | 63,625 | 48,313 | 13,725 | 10,567 | 54,432 | 4,681 | |
| May, | 11 | 24 | 43 | 64,221 | 47,367 | 13,346 | 10,504 | 52,917 | 3,749 | |
| June, | 11 | 24 | 43 | 61,650 | 49,648 | 12,935 | 11,322 | 52,653 | 4,132 | |
| | | | | 189,496 | 145.328 | 40,006 | 32,393 | 160,002 | 12,562 | 579,787 |
| July, | 11 | 24 | 43 | 67,120 | 47.976 | 12,925 | 10,337 | 47,263 | 4,008 | |
| August, | 15 | 34 | 45 | 68,244 | 49,726 | 13,311 | 10,057 | 48,405 | 4,294 | |
| Sept., | 15 | 34 | 45 | 69,513 | 54,646 | 14,968 | 13,202 | 46.937 | 4,090 | |
| | | | | 204,877 | 152,348 | 41,204 | 33,596 | 142,605 | 12,392 | 587,022 |
| Oct., | 15 | 34 | 45 | 75,892 | 59,299 | 15,692 | 14,244 | 52,172 | 4,283 | |
| Nov., | 15 | 34 | 45 | 69,671 | 54,339 | 12,630 | 11,619 | 50,749 | 3,791 | |
| Dec. | 15 | 34 | 45 | 81,456 | 69,400 | 14.991 | 14,515 | 60.158 | 4,591 | |
| | | | | 227,019 | 183 038 | 43,313 | 40,378 | 163,079 | 12,665 | 669,492 |
| 1885. | | | | | | | | | | |
| Jan., | 16 | 38 | 48 | 85,652 | 61,434 | 15,390 | 11,622 | 61,497 | 5,392 | |
| Feb., | 16 | 38 | 48 | 77,623 | 52,723 | 13,667 | 10,533 | 51,905 | 4,907 | |
| March, | 16 | 38 | 48 | 80,145 | 56,217 | 17,832 | 12,013 | 56,729 | 5,399 | |
| | | | | 243,420 | 170,374 | 46,889 | 34.168 | 170 131 | 15,698 | 680,680 |
| April, | 16 | 38 | 48 | 81,931 | 55, 21 | 17,132 | 11,727 | 56,288 | 4,673 | |
| May, | 16 | 38 | 48 | 77,373 | 53,019 | 18,860 | 12,590 | 52,876 | 5,215 | |
| June, | 16 | 38 | 48 | 86,088 | 58,292 | 19,984 | 12,992 | 56,107 | 5.387 | |
| | | | | 245.392 | 166,832 | 55,976 | 37,309 | 165,271 | 15,275 | 686,055 |
| July, | 16 | 38 | 48 | 80.849 | 58,689 | 18,366 | 12,338 | 58,439 | 5,911 | |
| August, | 16 | 38 | 48 | 79,775 | 53,844 | 17,466 | 10,781 | 52,574 | 6,438 | |
| Sept., | 17 | 42 | 53 | 85,544 | 54,793 | 17.343 | 11,262 | 56,579 | 4.779 | |
| | | | | 246,168 | 167.326 | 53,175 | 34,381 | 167,592 | 17,128 | 685,770 |
| Oct., | 17 | 42 | 53 | 94,455 | 58,438 | 18,110 | 11,700 | 61,568 | 4,771 | |
| Nov., | 17 | 42 | 53 | 88,671 | 57,100 | 20,274 | 11,315 | 57,731 | 4,489 | |
| Dec. | 17 | 42 | 53 | 97,654 | 61,991 | 19,409 | 11,715 | 68,642 | 5,363 | |
| | | | | 280,780 | 177.529 | 57.793 | 34.730 | 187.941 | 14,623 | 753,396 |
| 1886. | | | | | | | | | | |
| Jan., | 19 | 47 | 61 | 94,813 | 58,521 | 18,565 | 11,481 | 62,862 | 5,392 | |
| Feb., | 19 | 47 | 61 | 92,479 | 57,460 | 18,052 | 10,882 | 61,206 | 5,894 | |
| March, | 19 | 47 | 61 | 102,700 | 67,408 | 22,921 | 13.925 | 85,857 | 5.930 | |
| | | | | 289,992 | 183,389 | 59,538 | 36,288 | 209.925 | 17,216 | 796,348 |
| April. | 19 | 47 | 61 | 96,449 | 58.367 | 22 397 | 11.668 | 70.245 | 5,420 | |

| | | |
|---|---|---|
| No. of pieces handled 1st quarter of 1884 | . . . . . . . | 520,725 |
| " " " " " " " 1885 | . . . . . . . | 680,680 |
| " " " " " " " 1886 | . . . . . . . | 796,348 |
| " " " delivered 1884 | . . . . . . . . . . | 1,559,324 |
| " " " collected " | . . . . . . . . . . | 797,702 |
| Total No. of pieces handled, 1884 | . . . . . . . . | 2,357,026 |
| " " " delivered, 1885 | . . . . . . . . | 1,920,528 |
| " " " collected, " | . . . . . . . . | 885,373 |
| " " " handled, " | . . . . . . . . | 2,805,901 |

Attention is also directed to the following communication from the Hon. D. M. Connolly, P. M. at Scranton:

"United States Post Office,
"Scranton, Pa., June 15, 1886.

"Col. J. A. Price, President Board of Trade:

"*Sir*—At your request I have prepared a statement showing the business done in the Free Delivery Department at this office each quarter since the carrier system was introduced here, viz.: November 1st, 1883.

"We were allowed at first 10 carriers. On the 1st of January, 1884, the number was increased to 11; on August 1st, to 15; Jauuary 1st, 1885, to 16; September 1st, to 17; and January 1st, 1886, to 19. We will, in a short time, require a still further addition to the force, owing to the rapid growth of the city, and increase of postal business.

"The number of delivery trips made by the carriers daily in 1883 was 18. They now make 47 trips daily.

"The number of pieces of mail matter handled by carriers during the first quater of 1884, was 520,725. They handled during the first quarter of 1886, 796,348; an increase in the number of pieces of 275,623. During the year 1885, the number of pieces was 2,805,901; an increase over the year, 1884 of nearly half a million pieces. The present year will show a corresponding increase.

"During the year ending June 30, 1885, the average monthly sales of postage stamps, postal cards, and stamped envelopes, was about $3,000. Notwithstanding the reduction in newspaper and periodical postage, and the decrease in ordinary postal revenue, owing to the increase in weight of mail matter from one-half an ounce to one ounce, which went into effect July 1, 1885, the receipts from the sources above named during the present year will average $3,400 monthly.

"I am confident that in another year Scranton will become a first-class post office.

"The Scranton Post Office, during the past year, paid all expenses, including rent, light, salaries, etc., and remitted a surplus of about $10,000 to the United States Treasury.

"I desire to call your attention to the fact, that during the past year additional mail facilities have been given the people of Scranton, as follows: One way mail on the L. & B. Division of the D., L & W. R. R., between Scranton and Northumberland; one to Moscow and Stroudsburg, respectively; and three to Philadelphia. Steps have been taken looking to the appointment of a transfer clerk at the D., L. & W. R. R. station, and to the establishing of a mail service on the new 'Erie and Wyoming R. R.'

"In October last I directed that a collection should be made from the street letter boxes, in the business portion of Hyde Park, Providence, and Green Ridge, daily, at 9:30 P. M. Previous to that order a letter deposited in a street-box, in any of the places named, after 6 P. M., was not delivered in New York until the second day thereafter. Such letters are now delivered in New York the morning after they are deposited in the street-boxes.

"Scranton as a depository office, received during the past year deposits from about 400 fourth-class offices. The amount received is about $25,000 annually.

"The postal facilities at Scranton are about as good as they can be made, but no efforts will be spared to improve them as exprienece may suggest and opportunity allow.

"Very respectfully,

"D. W. CONNOLLY, P. M."

## BANKING CAPITAL.

The banking capital now aggregates $1.610,000, or, divided into its proper elements, it may be said to be—capital, $1,000,000; surplus, $610,000.

The deposits have reached a line of somewhat more than $5,000,000; and have increased 200 per cent in five years. Surplus has increased from 60 to 70 per cent in the same half decade, while the number of depositors has more than doubled.

The facilities are excellent, and the disposition to lay the business under tribute is nowhere displayed. Liberal dealing is a very marked feature of the banking department, while the standing of the institutions is without reproach or question.

## CITY FINANCES.

The city controller, in his report for the fiscal year ending March 31, 1886, says that the city is the "least burdened with taxes and has less indebtedness than any other city of 70,000 inhabitants of which we were able to find any report." The bonded indebtedness is $255,176.54, or $3.62 per individual. A tax levy of two per cent on the assessment valuation of $13,083,597 would leave the city practically free from indebtedness.

The healthful condition of the city finances is a subject for congratulation. The burden of taxation is lighter than in any known city of equal extent and population. The financial policy is universally economical—extravagant tendencies have found no foothold. A Cerberean watchfulness studies and guards appropriations and assessments.

The valuation of taxable property, $13,083,597, is barely more than one-third of the real value. The tax levy of 1885 was $145,-108.91, a mere fraction over one per cent. on the valuation, or, $2.06 per individual. It has no equal in the United States. Capital seeking investment can be guaranteed the most respectful consideration, and can be assured of permanent progress without exhaustion, exaction or material destruction. In this respect, the city offers unparalleled inducements to the location of industrial enterprises and all ranks of the industrial classes.

The appended report of the City Controller, omitting the details, exhibits the most flattering financial condition:

## ANNUAL REPORT.

Fiscal Year, Ending March 31, 1886.

*To the President and Members of the Select and Common Councils of the City of Scranton:*

Gentlemen—I have the honor herewith to present to you the ninth annual report of the City Controller for the fiscal year, March 31st, 1886.

* * * * * * * *

The total bonded debt of the city is $319,000, from which should be deducted cash and bonds in the sinking fund, $63,823.46, leaving actual bonded indebtedness $255,176.54, showing a decrease of the funded debt of $12,104.08 since my last report.

The floating debt, as represented by unpaid warrants and balances of unexpended appropriations, is $63,432.52. At the time of my last report, estimated in the same manner, the floating debt was $67,336.21, showing a decrease of $3,903.69.

* * * * * * * *

| | | |
|---|---|---|
| Bonded Indebtedness— | | |
| First Series, 7 per cent, 20 years, payable June 1, 1893, | $219,000 00 | |
| Second Series, 6 per cent, 20 years, payable December 1, 1896, | 100,000 00 | 219,000 00 |
| Less Sinking Fund— | | |
| Bonds purchased, 7 per cent, first series, | 13,000 00 | |
| Cash on hand, | 50,823 46 | |
| Total, | $ 63,823 46 | |
| Balance bonded debt, | | $255,176 54 |

*   *   *   *   *   *   *   *

The appropriation for general city purposes for the year ending April 1st, 1886, amounted to $101,000. The Treasurer has received on account of the year's revenues $93,567, and there remain uncollected upon the duplicates of the year some $15,000.

ASSESSMENT AND TAX LEVY.

| | |
|---|---|
| Assessment valuation— | |
| Occupation, | $ 850,370 |
| Personal property, | 153,719 |
| First class property, | 2,085,693 |
| Second " " | 7,476,942 |
| Third " " | 2,488,072 |
| Dogs (school purposes) | 28,800 |
| Total amount for 1885 | $ 13,083,597 |

| | |
|---|---|
| Levy, general— | |
| On first class property, | 10 mills |
| second " " | 6⅔ " |
| third " " | 5 " |
| Occupation, " | 10 " |
| Special— | |
| On first classs, occupation and personal | 4 mills |
| second " | 2⅔ " |
| third " | 2 " |

| | |
|---|---|
| Amount of tax duplicate for 1885— | |
| City tax, general | $ 93,186 21 |
| special | 48,922 70 |
| Total | $145,108 91 |

*   *   *   *   *   *   *   *

The appropriations for the year ending March 31st, 1887, are already made—based in accordance with the ordinance of the councils, upon the revenues of the last year. It is sincerely to be hoped that the system thus adopted by you will be rigidly adhered to, and that no effort may be made to increase the expenditure beyond the estimate of receipts as furnished, and thus keep our city with the proud record of being the least burdened with taxes and have less indebtedness than any other city of 70,000 inhabitants of which we were able to find any report

EDWARD C. DIMMICK,
*City Controller.*

---

# THE FIRE DEPARTMENT.

The voluntary system prevails. It is efficient and popular, and continues a pride of organization and membership. The department has never suffered defeat in controlling any fire. Telephone connection is established with every part of the city, and steam gong alarms are sounded at the instant of discovery of fire in any district. The city appropriates annually to the expenses of the department, and owns the property to the value of $30,421.

The control of the department is vested in a chief and six district engineers. The present chief, Mr. H. F. Ferber, is a fireman of twenty years' experience. The city owns seven engine houses and rents six, five steamers, two hand engines, five hose companies and one hook and ladder equipment, besides 3,000 feet of No. 1 hose, 2,000 feet of No. 2 hose, and 1,000 feet of No. 3 hose.

There are in the city 190 hydrants, with hydrant pressure ranging from 40 to 120 pounds, according to the location. Complete security is regarded by residents. The splendid past record of the department warrants the fullest confidence in the future. Insurance rates are correspondingly low, and exhibit a pleasurable reliance upon the effectiveness of organization and the ability to take care of any conflagration.

The entire force comprises 377 men, divided into companies as follows:

NAMES OF COMPANIES AND MEMBERSHIP OF EACH.

| | Members |
|---|---|
| Columbia Hose Company No. 5, | 20 |
| Crystal Hose Company No. 4, | 33 |
| Franklin Fire Company No. 1, | 15 |
| Nay Aug Hose Company No. 1, | 35 |
| Neptune Engine Company No. 2, | 21 |
| Eagle Engine Company No. 5, | 22 |
| Relief Engine Company No. 3, | 32 |
| Liberty Hose Company No. 2, | 21 |
| Niagara Hose Company No. 7, | 30 |
| Phœnix Hose Companny No. 6, | 28 |
| Gen. Phinney Engine Company No. 4, | 40 |
| Excelsior Hose Company No. 8, | 40 |
| Hook and Ladder Co., | 40 |
| | 377 |

# CRIMINAL RECORD.

The city spends upon its police regulation less than $17,000, and its force consists of one chief, one sergeant and sixteen men. The statistics of crime herewith submitted in detail, and the accompanying fact that the peace has been fully maintained with this force and with the above expenses contrasts favorably with any exhibit in the world. The student of social evils will be astounded at the result declared, and which has been steadily maintained. The record shows that the larger crimes are at a minimum, and that we are the safest and most orderly community on the globe.

| | | Residence. | | | Nativity. | | | | Offenses for which Persons were Arrested. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of Arrests. | Scranton. | Others. | Total. | American. | Irish. | Others. | Total. | Burglary. | Drunkenness. | Drunk and disorderly. | Disorderly conduct. | Larceny. | Murder. | Attempt at rape. | Attempt to kill. | Assault and battery. | Vagrancy. | Lunacy. | Highway Robbery. | Defrauding. | Indecent exposure. | Carrying concealed weapons. | Keeping house of prostitution. | Frequenting house of prostitution. | Others. | Total. |
| For year ending March, 1879.......... | 534 | 391 | 143 | 534 | 209 | 192 | 73 | 534 | ... | .... | .... | ... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | ... |
| For year ending March, 1880.......... | 693 | .... | .... | 693 | .... | ... | .... | 693 | .... | .... | .... | .... | .... | ... | .... | ... | .... | .... | . .. | .... | .... | .... | ... | ... | ... | .... | .... |
| For year ending March, 1881.......... | 984 | 793 | 191 | 984 | 455 | 309 | 220 | 984 | 10 | 487 | 268 | 39 | .... | 2 | 2 | ... | 18 | 35 | 25 | .... | 1 | 8 | 10 | 2 | 6 | .... | 984 |
| For year ending March, 18?2.......... | 899 | 706 | 193 | 899 | 423 | 251 | 216 | 899 | .. . | 392 | 306 | 28 | 29 | 3 | 4 | 4 | 22 | 18 | 8 | 5 | 1 | 4 | 7 | 5 | 19 | .... | 899 |
| For year ending March, 1883...... .... | 864 | 674 | 190 | 864 | 408 | 244 | 212 | 864 | .... | 354 | 366 | 22 | 7 | ... | .... | 6 | 28 | 18 | .... | 1 | .... | 4 | 18 | .... | 7 | 29 | 864 |
| For year ending March, 1884...... .... | 938 | 773 | 165 | 938 | 478 | 215 | 245 | 938 | .... | 423 | 372 | 24 | 16 | 3 | .... | 1 | 9 | 28 | 16 | 5 | . | 4 | 16 | 1 | 1 | 9 | 938 |
| For year ending March, 1885.......... | 1400 | 589 | 811 | 1400 | 708 | 386 | 306 | 1400 | 16 | 446 | 91 | 139 | 60 | 1 | 8 | 7 | 84 | 424 | 9 | . . | .... | 4 | 15 | 10 | 35 | 65 | 1400 |
| For year ending March, 1886....... ... | 649 | 350 | 299 | 649 | 325 | 122 | 202 | 649 | 4 | 310 | 71 | 40 | 30 | .. | 3 | 11 | 19 | 72 | .... | 26 | ... | .... | 2 | 1 | 11 | 49 | 649 |

The excess in 1885 is accounted for by the fact that vagrant lodgings were provided, the increase being in vagrancy and in no way connected with crime.

## PUBLIC SCHOOL SYSTEM.

Public instruction is based upon the curriculums and regulations of the older cities. The various grades of Primary, Intermediate, Grammar, Preparatory and High, afford sufficient scope for the largest desire of elementary and fundamental education. In the High School sub-department the languages, Greek and Latin, Botany, Chemistry, Geology, Astronomy, Political Economy, etc., etc., are taught. The management has been liberal without extravagance, and has always fully justified the hope in progressive development. From A, B, C, to the college course is possible for any who seek or strive to attain it.

There are 32 public buildings that belong to the School Department, in which 103 schools are maintained. The teachers now number 230, and the pupils 8,420; composed of 3,920 males and 4,500 females. The attendance averages about 90 per cent. of the number of pupils. The increase of public school patronage has increased from 2,135 to 8,420 in seven years, equal to about 300 per cent.

The total expenditure for the past year was $138,742.27. The rate paid teachers averages about $40 per month. The department is also expending from 15 to $40,000 per annum in the erection of new buildings and in increasing the capacity of the system. The buildings and grounds are substantial and of high class, while they are lighted, ventilated and heated in the most approved manner.

A deaf mute school is also maintained with an attendance of 13, over which a capable and experienced teacher presides, and the progress in the oral development of the mute is a subject of wonderment.

## PRIVATE SCHOOLS.

A number of these enterprises are scattered over the city in the hands of specialists. A very liberal culture is aimed at throughout, for there are, besides the belles-lettres and preparatory, schools in music, gymnastics and physical development.

The city of Scranton looks with no measured satisfaction upon its school system and its oportunities for instruction.

---

## HEALTH AND MORTALITY.

*No one dies here except by old age or accident.*—(Common saying).

Scranton is surrounded by mountains 2,000 feet above sea level, and is itself loftily located at 750 feet above tide. Freedom from disease and longevity are incident to the locality. The number of physicians do not average one to a thousand people.

The death-rate is the lowest on the continent, if not in the world, of any city of like population, being only 13 in the thousand population. The death rates of cities run very largely ahead of this mininum, and small towns and villages exceed it by four and five per thousand inhabitants. It is rare, indeed, either in the United States or in England, to fall below 17 to the thousand in mortality rate.

Typhoid is little known, and epidemics do not prevail. The water of the locality, drawn from Nature's supply, directly from the high mountain ranges on the East and West of the city, is without exception of purest quality; and the drainage of the central basin into the Lackawanna River undoubtedly sustains this small percentage of disease and of mortality. With every rain the city is flushed, and the lingering accumulation of filth is nearly impossible. The following table for six years will warrant the strongest comment and assertion that there is no single locality on the globe that equals the favor of the city in this respect.

REPORTED MORTALITY FOR THE YEARS ENDING DECEMBER 31, 1830, 1881, 1882, 1883, 1884, 1885.

| | | AGE BY YEARS. | | | | | | | | | | | | | | | | | | | SEX. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Under 1 year. | 1 to 2. | 2 to 3. | 3 to 4. | 4 to 5. | Total under 5 years. | 5 to 10. | 10 to 15. | 15 to 20. | 20 to 25. | 25 to 30. | 30 to 35. | 35 to 40. | 40 to 45. | 45 to 50. | 50 to 55. | 55 to 60. | 60 to 65. | 65 to 70. | 70 and over. | Male. | Female. | Colored. |
| Total deaths for the year 1880 | 448 | 68 | 52 | 29 | 18 | 24 | 191 | 30 | 10 | 22 | 21 | 18 | 19 | 20 | 12 | 17 | 18 | 24 | 16 | 9 | 21 | 257 | 191 | |
| Total deaths for the year 1881 | 483 | 105 | 40 | 14 | 14 | 14 | 187 | 46 | 15 | 22 | 16 | 20 | 15 | 18 | 16 | 24 | 12 | 25 | 24 | 16 | 27 | 277 | 206 | 4 |
| Total deaths for the year 1882 | 530 | 109 | 45 | 19 | 12 | 7 | 192 | 37 | 35 | 17 | 23 | 13 | 26 | 33 | 18 | 14 | 19 | 19 | 26 | 11 | 47 | 297 | 251 | 2 |
| Total deaths for the year 1883 | 712 | 152 | 69 | 27 | 14 | 16 | 278 | 35 | 24 | 32 | 49 | 36 | 28 | 25 | 26 | 28 | 29 | 27 | 30 | 11 | 54 | 373 | 339 | 4 |
| Total deaths for the year 1884 | 950 | 211 | 79 | 39 | 38 | 34 | 407 | 55 | 23 | 29 | 47 | 46 | 37 | 43 | 52 | 35 | 38 | 28 | 36 | 31 | 49 | 529 | 421 | 3 |
| Total deaths for the year 1885 | 988 | 197 | 123 | 56 | 34 | 24 | 432 | 57 | 38 | 28 | 50 | 60 | 29 | 36 | 43 | 36 | 39 | 45 | 39 | 18 | 36 | 570 | 418 | 3 |

# PRIVATE CHARITY AND CITY HOSPITALS.

There are two homes for friendless children, maintained by private charity in the city, a society for the prevention of cruelty to animals, and two hospitals. These institutions are all in a flourishing condition. The most conspicuous is that known as the Moses Taylor Hospital, which has been endowed with a fund of nearly $500,000, and is destined to be one of the most notable institutions in the state and nation. It is founded with the definite purpose of extending its benefits to railway and mining injuries. In a city where machinery is such an important element of progress and of life, it is natural that accidents of a horrible character should be more frequent than elsewhere, and the field for this noble charity will be very broad.

---

# MANUFACTURING, ETC.

The manifest destiny of Scranton is, like that of Sheffield and Birmingham, in manufacturing. $25,000,000 of capital are already employed outside of the railroad and coal interests, and it is estimated that 37 per cent of the people are producers. The smaller industries employ upward of 2,000 people.

Adults and heads of families are employed in the coal, iron and steel interests, consequently there is a large percentage of young people that can only find usefulness in the lighter industries. Silk mills and underwear garments already take up a large portion of the surplus, but there is yet a vast reserve that may be employed with profit by incoming institutions. In all branches of labor the supply is abundant and moderate in its demands. The population of the city, besides the native-born, consists of Irish, Welsh, Germans, Scotch and English, in the relative proportion of the order in which they are enumerated. Their resident connections in the old country constitute this element a constant source of supply as new wants are created, so that at no time is there a dearth of labor to be anticipated.

It is the custom of the city to free new industries from taxation for a period of ten years, by naming a nominal figure of valuation on the property; for instance, a property worth $100,000 or $200,000 is valued for taxable purposes at $100 for the period above mentioned. All such encouragement is given new industries, and it demonstrates the good fellowship and hearty welcome that is extended.

No argument or advocacy can be as powerful as the foregoing statements and tables in regard to the stable power already attained by the city in the progressive development of the age; and nothing can be more completely convincing as to the definite prospect in the future. As a place of active enterprising affairs, as well as of peace, safety and health, it has no equal. It is indeed the giant young city of civilization.

The Board of Trade has been active in forwarding development, and in presenting the infinite and abounding resources with which the city is surrounded. It extends its most hearty and cordial invitation to capitalists, investigators and industrial managers, to avail themselves of the opportunity to become familiar with the cheap power that is constantly accumulating in quantity with the undiminished out-put of anthracite. The possibilities of the coal waste are vast, whether put to use as pure waste or powdered or generated into gas, either and all of which have peculiar and decided advantages, such as are offered nowhere else in the universe.

## HONORABLE MENTION.

The acknowledgments of the Board of Trade are hereby made and thanks tendered for favors received and services rendered in the preparation of this report to the following gentlemen:

MR. W. R. JONES, Superintendent Edgar Thompson Steel Co.
PROF. T. S. C. LOWE, Lowe Gas Co.
DR. GIDEON MOORE, Chemist, New York.
HON. D. W. CONNOLLY and ASSISTANTS, City.
MR. J. H. DUHIGG, Health Department, City.
PROF. R D. SCHIMPFF, Secretary School Board, City.
MR. H. F. FERBER, Chief Fire Department, City.
MR. B. R. WADE, Chief of Police, City.

---

## ADDENDA.

The number of names appearing in the 1886 Directory, compiled by Wanton S. Webb, Esq., of Providence, R. I., is 20,019. Computing upon the former basis of 4⅓ persons to the Directory name, as established by the census of 1880, we have the following result:

**Population City of Scranton, 1886, 86,749.**

# TABLE OF CONTENTS.