pilgrims, and the menu will be an artistic triumph for the caterer, who will be accorded carte blanche for the occasion.

Gen. Silas Seymour, the Republican candidate for New York State Engineer, is fifty-five years of age. He held the office of State Engineer and Surveyor in 1855 and 1856. He is best known from his connection with engineering works throughout the country. For sixteen years he was assistant engineer of the Erie Railway, and for many years was consulting engineer of the Union Pacific road. He has also been identified with the construction and equipment of the Lexington & Nashville, Mississippi & Ohio, Sacramento Valley and other roads. He was chief engineer and general superintendent of the Buffalo and New York City Railroad. He was awarded much praise for his work in constructing the Portage Bridge.

There is talk among army officers of the appointment of General Cyrus H. Comstock, of the Engineer Corps, to the Superintendency of the Coast and Geodetic Survey, vacated recently by the death of Captain Carlile Patterson. General Comstock is stationed at Detroit. The geodetic survey of the lakes has just been completed under his directions. His attainments have been recognized abroad as well as here, and on all sides the appointment is spoken of as one that would be eminently fitting. There is no movement in General Comstock's behalf by his friends, except perhaps an occasional individual recommendation, and he has no idea yet that he is thought of in connection with the place.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.*

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 407.)

CVIII.—AUBURN.

Auburn, New York, in lat. 42° 55′ N., long. 76° 36′ W., is on the outlet of Owasco Lake, which flows through the city and furnishes a valuable water power.

The city is built on high, uneven ground.

First settled in 1793 it was incorporated as a city in 1848.

In 1864, the population being about 14,000, water-works were constructed by a private stock company, taking water from the outlet of Owasco Lake, which is 12 miles long and 1 mile in average width, and has an area of 7,400 acres. It is surrounded by slaty hills, and the area of its water-shed including the lake is 156 square miles.

Water is impounded by a masonry dam 14 ft. high, one mile from the centre of the city, built jointly by the water company and the State of New York, the outlet being used when necessary as a feeder to the Erie Canal.

Water is pumped directly into the distribution mains by Holly pumps driven by three turbine wheels of 7, 5½ and 5 ft. diameter, and a reserve 200 horse-power steam engine. Domestic pressure of 50 lbs. and fire pressure of from 80 to 100 lbs. are maintained. The 5-ft. turbine drives a gang of six vertical pumps of 14-in. diameter and 12-in. stroke, with a capacity of 1,500,000 gallons in 24 hours.

Formerly there were two rotary pumps driven by two turbine wheels, all of which have been removed.

The 7 and 5½-ft. turbines now drive one 4-cylinder pump of 14-in. diameter and 17-in. stroke, with a capacity at 30 revolutions of 6,000,000 gallons in 24 hours, and two rotary pumps of 2,000,000 gallons capacity each.

The reserve steam engine is of the Holly pattern with 4 cylinders of 12-in. diameter and 24-in. stroke, and is geared to run any or all of the pumps.

The two larger turbines are also geared thus, and the steam and water power can be combined.

The water power is much less than formerly, and the pumping is done by steam for three to six months of the year.

Distribution was at first partly by cast-iron and partly by wrought-iron and cement pipes. In 1875 cast-iron began to be substituted for wrought-iron and cement, and now most of the cement pipe has been replaced by iron.

In 1880 there were 26 miles in use, of from 12 to 4-in. diameter, 10 miles being less than 6 in. in diameter, with 253 hydrants and 200 taps. The city pays for each hydrant $68.50 per annum.

During the present year the use of meters has been introduced in livery stables, breweries, and all manufacturing establishments.

In 1881 the population was 21,924 and the daily average consumption 2,600,000 gallons.

The cost of works and additions has been about $300,000. No statement of receipts and expenditures is furnished.

The works are managed by an executive committee of three.

The engineers and superintendents have been A. H. Goss, J. Lewis Grant, and Nelson B. Eldred, who is now superintendent and treasurer.

The president of the company is A. G. Beardsley.

CIX.—STILLWATER.

Stillwater, Minnesota, is in lat. 45° 2′ N., long. 92°, 45′ W., at the head of Lake St. Croix, on a small plain, surrounded by hills, which rise to an elevation of about 280 ft. above the valley.

The town was settled in 1842, and incorporated as a city in 1854.

Water-works were built by a private company in 1880, taking water from McKusick's Lake, about a mile from the centre of the city, and 159 ft. above the plain. The lake covers 55 acres, is from 6 to 10 ft. deep, and has a water-shed of about 6 square miles. A filter pit 100 by 50 ft., and 10 ft. deep, filled with gravel and charcoal over 2 by 4 inch strips of plank set on edge, receives the water from the lake. From the filter it passes into a reservoir 100 by 200 ft. by 10 ft. deep, whence a 24-in. earthenware pipe conducts it to the pump-well, 12 by 6 ft., and 12 ft. deep.

Two Blake pumps with 20-in. steam and 11-in. water cylinders, copper-lined, of 24-in. stroke, force the water into the mains. At Third and Myrtle streets, about a mile from the pumps, a 10 in. check-valve and 12-in. regulator, made by H. Mueller & Co., divide the high and low services. Two high-service pipes lead to the hills on the north and south, on each of which is a tank of plate iron 30 ft. in diameter and 20 ft. high. The regulator is 120 ft. below the pumping station and 240 ft. below the tanks, and about a mile distant from each.

It is intended to supply the lower service by gravity, using the pumping machinery only for the high service and fire protection. Distribution is by cast-iron pipe, of which 7.5 miles are laid, with 87 fire-hydrants and 129 taps. Meters have not been used.

The works have been in operation since December, 1880. The population in 1880 was 9,054. The daily consumption is 1,500,000 gallons. This large consumption is owing chiefly to the use of water for excavating sand to fill low ground. Several motors are in use to drive printing presses and other machinery.

The cost of maintenance to Oct. 1, 1881, was $2,430. The receipts from water rents had been $3,642. The city is to pay $7,000 per year for fire hydrants and the use of the water for the public buildings and free drinking fountains.

The cost of the works has been $200,000. The capital stock of the company is $100,000. Walter H. Sears, C. E., was the engineer of construction. The pumping machinery was built after the designs of H. H. Harrison, M. E., who is the superintendent. H. W. Cannon is the secretary and treasurer.

CX.—JACKSONVILLE.

Jacksonville, Florida, is situated on the west bank of the St. Johns River, 25 miles from its mouth, in lat. 30° 20′ N., long. 81° 40′ W. The elevation of the city above tide-water varies from 5 to 33 ft. It was incorporated in 1857. In 1879–80, water-works were built by the city, after the plans and under the superintendence of R. N. Ellis, C. E. Water is taken from a well 50 ft. in diameter and 31 ft. in depth, with walls of brick laid in Portland cement, which was sunk through sand 20 ft. to rock and into the rock 11 ft., intercepting several large streams of water in the rock, which supply 1,200,000 gallons in 24 hours. The well is covered with a slate roof.

Water is pumped into the mains by a Worthington duplex compound condensing engine of 1½ millions capacity in 24 hours. There is also a Worthington duplex non-condensing engine of the same capacity for reserve. Steam is furnished by two return tubular boilers, 5 ft. in diameter and 17 ft. 1 in. in length, built of steel; each boiler is large enough to run both pumps.

A small stand-pipe gives the ordinary service pressure, 40 lbs., which is shut off in case of fire, and the pressure raised to what is needed; ordinarily 75 lbs. are sufficient. Ten fine streams have been thrown at the same time to a height of 120 ft. with a pressure of 120 lbs.

The distribution is by cast-iron pipe. Eight miles have been laid from 14 to 6 in. in diameter. The connections to fire hydrants are all 6-in. There are 100 fire hydrants set and 50 stop gates. There are 200 taps in use, with 156 meters.

The population in 1880 was 8,000. The consumption is not stated. The cost of the works was $98,000. The works are managed by the trustees of the Sanitary Improvements Bonds. R. N. Ellis is the superintendent.

CXI.—JACKSONVILLE, ILL.

Jacksonville, Illinois, in lat. 39° 45′ N., long. 90° 18′ W., is on Mauvaisterre Creek.

In 1873, the population being about 8,000, water-works were built by the city, after the plans of E. S. Chesbrough, C. E., and under superintendence of E. Wolcott.

The supply is obtained by impounding the surface drainage in a prairie ravine by an earthen dam 18 ft. high. The drainage area is about 4 sq. miles of rolling prairie under cultivation. The site was excavated, and the reservoir, when full, is in no place less than 12 ft. deep. The reservoir has a capacity of 60,000,000 gallons.

Two direct-acting pumps built by Chas. B. Hardwick, one with steam cylinder of 26-in., water cylinder of 14-in. diameter, and 36-in. stroke, the other with steam cylinder of 26-in., water cylinder of 14-in. diameter, and 22-in. stroke, lift the water 133 ft. into the distributing reservoir which has a capacity of 2½ million gallons. It is 86 ft. above the city, circular, with earth embankments, and has inner slopes and bottom lined with clay and paved with brick.

The distribution is by cast-iron pipe. In 1878 there were 9 miles laid, of which 3 miles were less than 6 in. in diameter, with 70 fire hydrants and 200 taps.

The population in 1880 was 10,929. The daily consumption in 1876 was 225,000 gallons.

The works had cost, to 1876, $159,000 and the yearly cost of maintenance was about $3,500.

The works are managed by the city authorities. E. Wolcott had been superintendent from the beginning to 1876.

CXII.—PITTSFIELD.

Pittsfield, Massachusetts, in lat. 42° 26′ N., long. 73° 18′ W., is situated in an elevated valley. It was incorporated as a town in 1761.

In 1854 water-works were built by the town after the plans and under the superintendence of Phineas Ball, C. E., taking water from Ashley Pond and Ashley Brook, and Sackett's Brook, two sources of supply, and conveying it by gravity to two distributing reservoirs.

Ashley Pond has an area of 80 acres. The conduits are of cast iron, 10 and 12 in. diameter. The distributing reservoirs have a capacity of 1,000,000 gallons each. They are built of earth and stone. The respective elevations are 128 and 140 feet above the town.

Distribution was originally of wrought-iron and cement pipe, now replaced by cast-iron pipe. In 1878 there were 30 miles laid, with 70 fire hydrants. The number of taps in 1876 was 1,800.

The population in 1880 was 18,367. The daily average consumption in 1876 was 1,500,000 gallons.

The works cost to 1876 $195,000, and the yearly cost of maintenance was $1,800.

The works are managed by a board of water commissioners. R. A. Dunbar was superintendent to 1878. Later information has not been furnished.

CXIII.—MUSCATINE.

Muscatine, Iowa, on the Mississippi River, in lat. 41° 26′ N., long. 91° W., is built on a rocky bluff. It was first settled in 1836, and incorporated as a city in 1853.

In 1875–76, the population being 7,537, water-works were built by a private company after plans and under superintendence of W. C. Weir, taking water from the Mississippi River through a gravel filter 15 ft. square.

Two direct-acting plunger pumps, built by Cope & Maxwell, with steam cylinders of 16-in. diameter and water plungers of 10-in. diameter, with stroke of 30 in., the joint capacity being 1,500,000 gallons in 24 hours, lift the water from the river to the reservior, which is 172 ft. above high-water mark in the river, and furnishes the domestic supply, while fire pressure is obtained by direct pumping.

The distributing reservoir, which has a capacity of 1,000,000 gallons, is rectangular, in excavation and embankment, 16 ft. deep, has inner slopes of 1½ to 1 covered with puddle, and is lined with brick laid in cement.

Distribution is by cast-iron pipe. In 1878 3.5 miles had been laid, of which 250 ft. were less than 6 in. in diameter, with 40 fire hydrants.

The population in 1880 was 8,294. The cost to 1876 was $39,500. The consumption, revenue and expenses are not known. The works are managed by a private stock company. J. F. Gurluy was superintendent in 1876 and William Molis in 1878.

CXIV.—RAHWAY.

Rahway, New Jersey, in lat. 40° 38′ N., long. 74° 17′ W., is on the Rahway River at head of tide, 5 miles from its mouth, on Staten Island Sound. Settled in 1720, it was incorporated as a city in 1858.

In 1871 water-works were built by the city after the plans and under the superintendence of George H. Bailey, C. E., taking water from the Rahway River, and pumping it directly into the mains by a Worthington pumping engine of 1,500,000 gallons capacity.

Distribution is by wrought-iron and cement pipes, of which there were 9 miles laid in 1878, with 125 fire hydrants.

The population in 1880 was 6,480. The works cost to 1876 $185,000. The works are managed by a board of water commissioners. James M. Silvers was superintendent in 1878. Later information has not been furnished.

CXV.—TIOGA.

Tioga, Pennsylvania, is in lat. 41° 54′ N., long. 77° 12′ W.

In 1874 water-works were built as a private enterprise by, after plans and under superintendence of, C. H. Wickham, C. E., and A. F. Wickham, taking water from Beatty Creek, the watershed of which is 9 sq. miles.

Water is impounded by a timber dam thrown across the stream, forming a reservoir of 3,000,000 gallons capacity, and is filtered through a sand and charcoal filter in a wooden crib. The conduit is of 6-in. banded wooden pipe.

The distributing reservoir is 100 ft. square at the top and 80 ft. square at the bottom, and 15 ft. deep. Its capacity is 750,000 gallons. Distribution is by banded wooden pipe. In 1877 3 miles had been laid, of which 2 miles was of less than 6 in. in diameter, with 14 hydrants and 120 taps.

In 1877 the population was 1,000 and the daily average consumption 40,000 gallons per day. The works cost $16,000 and the yearly cost of maintenance is $250. The works are owned and managed by O. H. and F. A. Wickham.

CXVI.—MOUNT JOY.

Mount Joy, Pennsylvania, is in lat. 40° 6′ N., long. 76° 28′ W.

In 1873 water-works were built by the town, after plans and under superintendence of Henry P. M. Birkinbine, C. E., taking water from Chiquesalurga Creek, which drains a sandstone and slate formation and furnishes soft water.

Water and steam power are used to lift the water into the reservoir, which has a capacity of 500,000 gallons, and is in excavation and embankment. Direct pumping is used for fire protection.

Distribution is by cast-iron pipes, of which in 1877 37 miles were in use, with 23 fire hydrants.

The population in 1880 was 2,063.

The consumption, revenue and expenses have not been furnished.

The works to 1877 had cost $35,000.

The works are managed by the Town Council.

In 1877 William Kone was superintendent.

CXVII.—SOUTH HADLEY.

South Hadley, Massachusetts, in lat. 42° 18′ N., long. 72° 33′ W., is on the Connecticut River.

In 1872 water-works were built by the village, after plans of W. B. Harris, C. E., and under superintendence of E. C. Davis, C. E., taking water from springs on a table land 135 ft. above the Connecticut River and storing it in a reservoir of irregular form, covering 1 acre and 6 ft. deep.

The distribution is by cast-iron pipes, of which 6 miles had been laid in 1876, with 42 fire hydrants and 230 taps.

The population in 1876 was 1,500. The works had cost $54,000, and the yearly cost of maintenance was $500.

The works are managed by the fire district and a board of water commissioners, to which F. Carew was clerk in 1876.

(TO BE CONTINUED.)

We acknowledge MS. of the history of the water-works of Portland, Me., from George P. Wescott, C. E., Superintendent and General Manager.

CORRESPONDENCE.

WROUGHT-IRON SCREW BOLTS.

MILWAUKEE, Wis., Oct. 6, 1881.

EDITOR ENGINEERING NEWS:

What is the general practice in relation to the dimensions of the heads of wrought-iron screw bolts? Manufacturers in the West generally give screw bolt heads less dimensions than those given by Trautwine.

Is not the strength of heads, as given by Trautwine, page 374, very largely in excess of the strength of the bolt? Yours truly, L. Y. S.

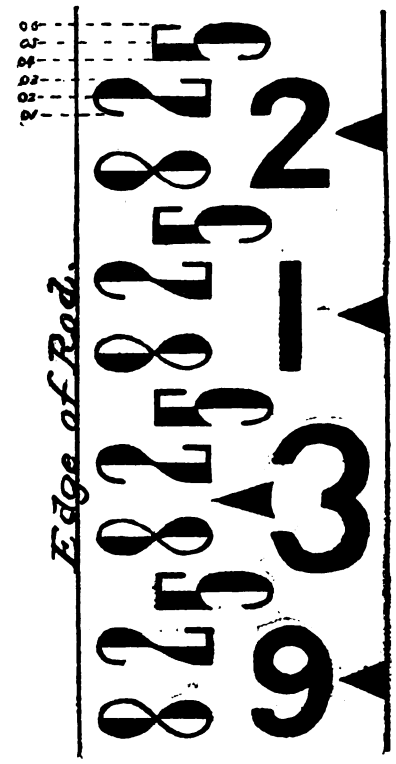
[The practice upon the Brooklyn Bridge, as we learned through the kindness of Col. Paine, has been to follow the Franklin Institute, or Sellers' System for Screw Threads and Bolts, except when the character of the work demanded a change. The nuts have been made of softer material than the bolts and of a thickness in excess of that of Trautwine, which is equal to the diameter of the screw. The difference in quality thus enabled the nut, when subjected to steam, to conform more closely to the bolt. The nuts upon the suspender rods which support the floor-beams were made much thicker than the diameter of the screw. The head need not be so thick as the nut. The strength of the nut as given in Trautwine is a little in excess of the strength of the bolt.—ED. ENG. NEWS.]

THE NEW FRANCIS ROD.

CITY ENGINEER'S OFFICE, CITY HALL,
PROVIDENCE, R. I., Sept. 25, 1881.

EDITOR ENGINEERING NEWS:

I have noticed of late considerable interest taken in the question of new methods of marking, for self-reading leveling rods. The representations in your paper show how general is the desire to arrive at a perfect self-reader. My idea of such a rod is that the divisions should be so marked as to enable one to distinguish instantly each from its neighbor, that there should be some difference in the shape and position of the divisions to prevent monotony and error, and that each division should be so marked that one might take the reading without counting or possibility of mistake. I take



pleasure in now presenting to the public, through your paper, a rod designed by Mr. H. N. Francis, assistant engineer in this office. I present it to you, with his consent, and hope that it will so far meet your approval that it may appear in your paper. Inclosed is a section of the rod for your inspection. It may explain itself, in that it is so simple. The marking seems a complete graduation to hundredths of a foot without visual division, and can be read without counting spaces. In fact, the figures 2, 5 and 8 are made to do double duty, which I think is a valuable point, as all visual division and counting of spaces of uniform shape and size must consume time, with liability to mistake.

At all reasonable distances it is considered as reliable as the target rod, with all the advantages of a self-reader. This system could easily be adapted to the "metric system."

The marking on the rod should be black on