## PLAN TO INCREASE THE WATER SUPPLY OF NEW YORK.

(*Continued from first page.*)

The aqueduct from Croton dam is of masonry lined with brick, and has a sectional area of 53·34 square feet. The Harlem River is crossed by the famous High Bridge, built of granite masonry, and having 8 spans of 80 feet and 7 spans of 50 feet, its length being 1,393 feet between the gate houses. The height is 100 feet in the clear above tide water. The water was first carried across in two 36-inch pipes, but in 1860 the capacity was enlarged by the addition of a wrought iron pipe 7 feet 6½ inches in diameter. This makes the pipes equal in capacity to the aqueduct.

Before 1840 a rectangular reservoir 836 feet wide, 1,826 feet long, and 20 feet deep, holding 150,000,000 gallons, was built about six miles from the Battery. Twenty years later a receiving reservoir having a capacity of 1,200,000,000 gallons was built next to this one. The distributing reservoir at Forty-second Street is 400 feet square, and holds 24,000,000 gallons. A high service reservoir holding 10,800,000 gallons was built in 1866 at the west end of High Bridge. Engines supply an iron stand pipe and tank, the flow line from which is 324 feet above tide level.

Elevations greater than this aqueduct are supplied by the two steam engines at High Bridge, which have a combined daily capacity of 10,000,000 gallons. In 1879–80 another high service supply was obtained from two engines pumping into a stand pipe 170 feet high located at Ninety-eighth Street. All of the water mains are of cast iron.

For several years the supply furnished by the present works has been insufficient; the population and manufacturing interests have grown more rapidly than was dreamed of, and, judging by the past, will continue to increase in a yearly greater proportion. That the case is urgent and demands quick and effective measures is not disputed. Two plans present themselves: one is to build so as to meet immediate wants, the other is to build to meet future wants—in other words, to build for ourselves only, or to build for our children's children. Nothing can show the fallacy of the first method better than the brief sketch above given of New York's water system, which has been only a succession of patches added every few years, each addition being probably made in the vain hope that the city would stop outgrowing its water supply. The alternative is to so build that we shall be prepared to supply an ample quantity of water for all the wants of all the people of New York city for all time.

Purity of the source of supply is the first and most important consideration. It would be hazardous to utilize a watershed which would require a system of drainage to remove material that might contaminate the water. It would be extremely foolish to take a water supply from a built upon section of country, every foot of which would have to be rigidly, carefully, and constantly guarded to keep away impurities. In deciding upon a plan to provide water for a city of the size and importance of New York, it is false economy to let the question of cost prevent the adoption of that scheme which will best meet all the requirements.

Several plans are now being considered by a commission appointed about a year ago to select a plan for obtaining an adequate supply. One of these is shown in our frontispiece. It contemplates damming the Croton River at Quaker Bridge, a point about four and one-half miles below the present Croton dam. This would catch all the water from the small tributaries of the Croton, the total watershed of which amounts to 362 square miles. The dam will measure about 192·5 feet from the top to the top of the foundation; and in the deepest part the foundation will be 69 feet high. The width at the base will be about 200 feet, and at the top 22 feet, on which will be a roadway. The length at coping will be 1,350 feet; length at datum level will be 510 feet; width at that level, 172 feet. Along the top of the face of the dam will be a line of arches forming a cornice. The outline drawings show a cross section and plan. The foundation will be concrete, and the main dam rubble masonry faced with stone work. The estimated cost of the dam is $5,000,000.

At the north end of the dam will be two spillways, formed between two knolls placed in a line, making an angle (down stream) with the dam. The waste water will run down a ravine, entering Croton River some distance below.

At a distance of six miles above Croton dam will be placed Muscoot dam, a subsidiary one designed purely for sanitary purposes; it will be the same height as the spillways of Quaker dam. The duty of this dam will be to keep the country constantly flooded, even if the water should be drawn off from both the Croton and Quaker ponds. The Quaker dam would raise the water level 34 feet above the top of the present Croton dam.

The present aqueduct will be connected with Quaker Pond at three levels, thereby permitting the selection of the purest water in the pond to be sent to the city. The old gate house at Croton dam will be enlarged and connected with both the Croton and Quaker ponds at different levels, to allow the drawing of water from either source. A new aqueduct will lead from here to the city. An aqueduct will connect Muscoot with Quaker Pond, in order to allow Croton Pond to be emptied without interfering with the supply. Openings will be made through Quaker dam, in order that the water may be drawn off if necessary.

It is calculated that Quaker dam will impound thirty-two billions of gallons of water, which would be sufficient for a 160 days' supply of 200,000,000 gallons each.

If carried out, this scheme, only the main points of which we have mentioned, would furnish a storage reservoir of ample size, and in a good locality if at any future time it became necessary to take water from a source further north. This idea is by no means a visionary one when we remember how our small streams are drying up.

## Correspondence.

### A Good Suggestion.

*To the Editor of the Scientific American:*

I have followed the advice of the SCIENTIFIC AMERICAN, and done what I could to defeat the proposed patent laws in Congress. In addition I have asked our Senator to amend section 4,900 of Revised Statutes so as to *require* manufacturers, when practicable, to affix to their patented goods the numbers and dates of their patents, and secondly, in all cases to furnish the numbers, dates, and title or subject of patents involved.

My reason for so doing is this: I have found in some makers of machinery, claimed by them to be patented, a disposition to make a secret of such numbers and dates. In some cases have been met by an impudent inquiry as to my motives in making such a request. Now, if I understand the spirit of the patent law, it is the right of every one to inquire fully into any patent he sees fit, and makers of patented goods should be compelled to give any inquirer the numbers, dates, and titles of their patents, if they offer goods, claimed to be patented, for sale.

I add the word title, because some machines have so many patents that it would be a great hardship to compel a person to buy copies of the whole lot in order to investigate one particular point.

W. S. PROSSER.

Anbury, Cal., April, 1884.

[The suggestions of our correspondent are good, and doubtless the public convenience would be promoted if patentees were required to stamp their goods as above indicated.—EDS.]

### A Trip on a Fast Locomotive.

*To the Editor of the Scientific American:*

Having occasion lately to pass over some branches of the Pennsylvania and Reading Railroad, a permit to ride upon the locomotives gave me opportunity to observe some striking points as to their work and wear.

At Bound Brook the Pennsylvania and Reading Railroad joins the Central of New Jersey, forming the Bound Brook line between Philadelphia and New York. South of that point Wootten locomotives are used on fast trains. North of it, standard Baldwins. The train leaving Philadelphia at 7:30 A.M., engine 364, makes the run to Jersey City in one hour and fifty minutes, schedule time, including some eight or ten stops and "slow ups." A stretch of seventeen miles between Princeton Junction and Bound Brook, including two slow ups and one stop, was run in exactly seventeen minutes. Of these seventeen miles, eleven in succession were run in nine minutes and ten seconds, being a rate of seventy-two miles per hour. And of these eleven, two successive miles were run in forty-seven seconds each, being a rate of 76·6 miles per hour. This was the regular daily run; we were not behind nor making up time.

Even at these high speeds the engine ran about as smoothly as a first class car. I have many times experienced severer vertical and lateral oscillations in such a car on reputable roads at forty-five miles per hour. So smooth, indeed, was the run that instead of any nervousness as to the safety of such speeds, the query constantly suggested was: Why may not a higher speed be obtained with entire safety? Or is there anything to prevent it but the problem of making the requisite steam?

In fact, safety at high speeds is aimed at in these engines, oddly enough, by placing the center of gravity very high—perilously high it at first appears; but when it is considered that the higher the inclination of the lines from the center to the rails, within the limit of safety from capsizing, the more lateral shocks will be eased by the springs, then it ceases to be a wonder that lateral oscillations are so little felt, for the reason that as *sudden* shocks they cease to exist. And take away the *sudden* heavy impact of the flange of the wheel laterally against the rail, and the danger of the wheel climbing the rail is taken away.

The firing and steaming of these engines is to be noted also, as they are the prime condition of the high speeds. The fire box is placed above the level of the top of the drivers, and extending out the full width of the engine overhangs them. An immense grate surface is thus obtained. Water tubes traverse the mass of fuel fore and aft, promoting circulation. The crown sheet is separated from the fire box by a wall of firebrick rising above the level of the fuel, and by a hot air or flame chamber between it and the fire brick. The crown sheets hold the largest number of the smallest brass tubes I ever saw in a locomotive boiler.

The force of the blast being expended through so broad an area of fuel the velocity of the air current through it is reduced, and as a result but very little cinder, and that the very finest, is ever drawn through the tubes. True, a spark arrester is placed in the smoke box—to comply with the law—but it arrests nothing, for nothing coarse enough to be arrested by it passes through the tubes, in other words, the stuff is all burned up in the fire box. The fact that these boilers are able to utilize what is known as "buckwheat" size coal, making steam very freely with it, is a strong point in their favor.

Notwithstanding the rapid evaporation effected—as high as forty-seven gallons per minute—they are not flighty. In the entire run above referred to the gauge did not vary three pounds from 135, due in part, perhaps, to an occasional blow-off, while slowing into the water tank.

Let any one who is in love with a swift, easy motion, like being borne through the sunlight on the thigh of a big angel, get a ride on one of these machines.

On the return from New York, I rode to Bound Brook on a Baldwin engine, No. 165, having a remarkable record, viz., that of having run 119,360 miles consecutively, without any general repairs, her weight having not once been lifted from her drivers in that period.

On the following day a run up the valley of the Schuylkill to Pottsville and back, gliding along fair interval lands, sweeping around bold mountain bases, rushing through those roaring hives of iron industry, and even making the descent, 1,300 feet, of Pleasanton's coal shaft, all could not divert attention from the fact that a small angel may make a very swift flight, the little Ariel, the manager's private engine, elegantly fitted to carry six persons, at our service, with little cylinders of ten inch stroke and drivers of three and a half feet, making a speed often of forty-five miles per hour.

The present advanced condition of railway service, however, has vastly more in it suggestive of advancement yet to be made than of perfection reached; and he is a bold prophet who undertakes to tell what the railway of the future shall *not* be.

B. W. P.

### An Illinois Inventor to Illinois Senators.

Mr. Eric U. Norberg, of Toulon, Ill., has written to the Senators from Illinois, concerning the hostile patent bills, as follows:

"If such stupid and unjust bills should become law, it would not only be a gross violation of the rights already granted to inventors, but would also have a tendency to stop at once all inventions hereafter. It would be a legislation in support of the bad principles advocated by the socialists and communists, denying individual or separate rights in property; and if, in the start, one class of property is by law declared to be common property, owned by no one particularly, how long would it take till such a fanatical and wild doctrine would include all other property?

"There is already considerable excitement over these hostile patent bills, and many are more or less uneasy for fear they may become law, and this excitement may lead to a political organization for the protection of this interest.

"The superior wisdom of the Senate cannot overlook the fact that a large part of the productive industry of the country is the direct result of useful inventions, and that the successful development of our vast resources, our future prosperity and progress, if not civilization itself, depends to a great extent not only on inventions already made, but also on such that skill and ingenuity may hereafter bring forth.

"For these reasons herein set forth, I respectfully ask that you will use all your influence to prevent the concurrence by the Senate in, or passing, any of the bills referred to above."

### The Milling World Says:

"The patent bills offer a fruitful field of discussion to all trade journals at the present time. If public opinion has anything to do with the formulation of laws, surely the advocates of the pending new patent regulations must have found out by this time that the large majority is against them, for all journals are most unanimous in condemning the bills as well as their advocates. A correspondent of the SCIENTIFIC AMERICAN touches a key note by the proposal that all inventors, and those interested in the progress of the country, should obtain as many signatures as possible to a pledge, that no advocate of any of the present new bills shall ever receive their vote at any election. Such pledges pouring in on these wise law makers from all parts of the country would beyond doubt have the desired effect upon the legislators, and demonstrate to them in what direction they must look for political support. The *Milling World* cordially indorses such a proposition, with the firm conviction that our existing patent laws, because far from perfect, should be made more efficient for the protection of the interests of both inventor and public, but not changed in any other manner. If we cannot improve them for the benefit of everybody, do not let us try to alter them to the detriment of many and to the advantage of a few mercenary individuals, but rather let 'well alone' and leave them in the present form."

### Training Dogs to Patrol Mines.

A Zanesville, O., correspondent writes us that dogs may not only be made profitable workers in mines, by being taught to draw small coal cars, but it is entirely feasible to teach them to patrol mines, as detecters of the presence of fire damp or natural gas. A dog of 16 or 20 inches high is recommended as likely to be most serviceable in the work, but he should be so trained by the watchman as to be always ready to rapidly make the rounds of the mine before the latter starts. The plan is to send the dog through the mine. If he returns, it will be known that the mine is safe. Failure of doggy to come back indicates danger from gas.

**Manganese: its Ores and their Uses.**

BY PROF. E. J. HALLOCK.

In commerce and the arts the term "manganese" is applied to an ore, the technical name of which is *pyrolusite.* The term "brown stone" is likewise a misnomer, since this ore is not brown, but black, intensely black, as those who handle it well know, for it blackens the hands like coal.

In its scientific meaning the word "manganese" is applied to a metal that occurs in a number of other ores as well as in pyrolusite, and somewhat resembles iron both in its pure state and in its compounds.

Pyrolusite in a binoxide of the metal manganese, and in early times was mistaken for an ore of iron. From its resemblance to loadstone it was called *magnesia nigra.* The earliest mention of it, according to Bolton's *Index to the Literature of Manganese,* may be found in Cæsalpin's *De Metallicis,* published in 1596. Although known so long, and quite extensively employed by glass makers, it was not until 1740 that Pott found that the metallic element which it contained was not iron. (*Miscel. Berolinensia,* vi., 40.)

As already mentioned the first use that manganese compounds found was in glass making, to destroy the greenish tinge caused by iron; following this came the discovery of "chameleon mineral" by De Morveau in 1780-90 (*Jour. de Physic*). In recent times, however, it has found a use in metallurgy, which has greatly increased the demand for its ores.

The principal ores and minerals containing manganese are the following:

*Pyrolusite,* or black oxide of manganese, containing 63 per cent of metal, when pure. It occurs either crystalline or massive. The former forms long columns, which are often divergent, forming rays, either iron black or steel gray in color, and having a metallic luster. When massive, it looks granular and opaque. Its hardness varies, while its specific gravity is 4·82. It occurs abundantly in different parts of this country from Vermont to Georgia and California. It is easily recognized by the copious evolution of chlorine gas when heated with hydrochloric acid, and of oxygen when heated with strong sulphuric acid, in connection with the usual manganese reactions, viz., an amethystine bead with borax, a green one with soda.

*Manganite,* a hydrated oxide of manganese, with 62½ per cent of the metal. Its appearance and characteristics resemble those of the former ore.

*Psilomelan* is also a hydrate, and like pyrolusite dissolves in hydrochloric acid with the evolution of chlorine. It is found massive, stalactitic, or in rounded masses, but never crystalline. It is found at Chittenden, Irasburg, and Brandon, in Vermont.

*Wad* is a loosely aggregated hydrate of bluish or brownish black color. It seems to have resulted from the decomposition of other manganese ores. It often contains iron, cobalt, barium, and copper. It occurs abundantly in this State and elsewhere.

*Rhodochrosite,* or carbonate of manganese, is the most beautiful mineral of this class, and finds use as ornament rather than ore. In color it varies from pink to rose red and brown, being mottled or shaded with various tints. Its luster, when polished, gives it the appearance of a beautiful marble. It has been found in New Jersey and Nevada, but is not abundant.

*Franklinite* deserves mention here, as it contains 12 to 16 per cent of the oxide of manganese, and is very abundant in New Jersey,

Manganese occurs in many other minerals, and even in the ashes of plants, especially those of birch leaves.

The ores of manganese are much more difficult to reduce than those of iron, which they otherwise resemble, hence metallic manganese is rarely prepared in a free state, but is well known in its alloys with iron known as ferromanganese and spiegeleisen.

Metallic manganese can be prepared from the oxide by reduction with carbon at a very high temperature. Also by the action of sodium upon the fluoride. It looks like cast iron, but with a tinge of red and is hard enough to scratch glass and steel. It melts at a white heat, but is permanent in the air. Unlike iron, it possesses no magnetic properties, and when alloyed with iron to the extent of 22 per cent the latter ceases to exhibit magnetic properties.

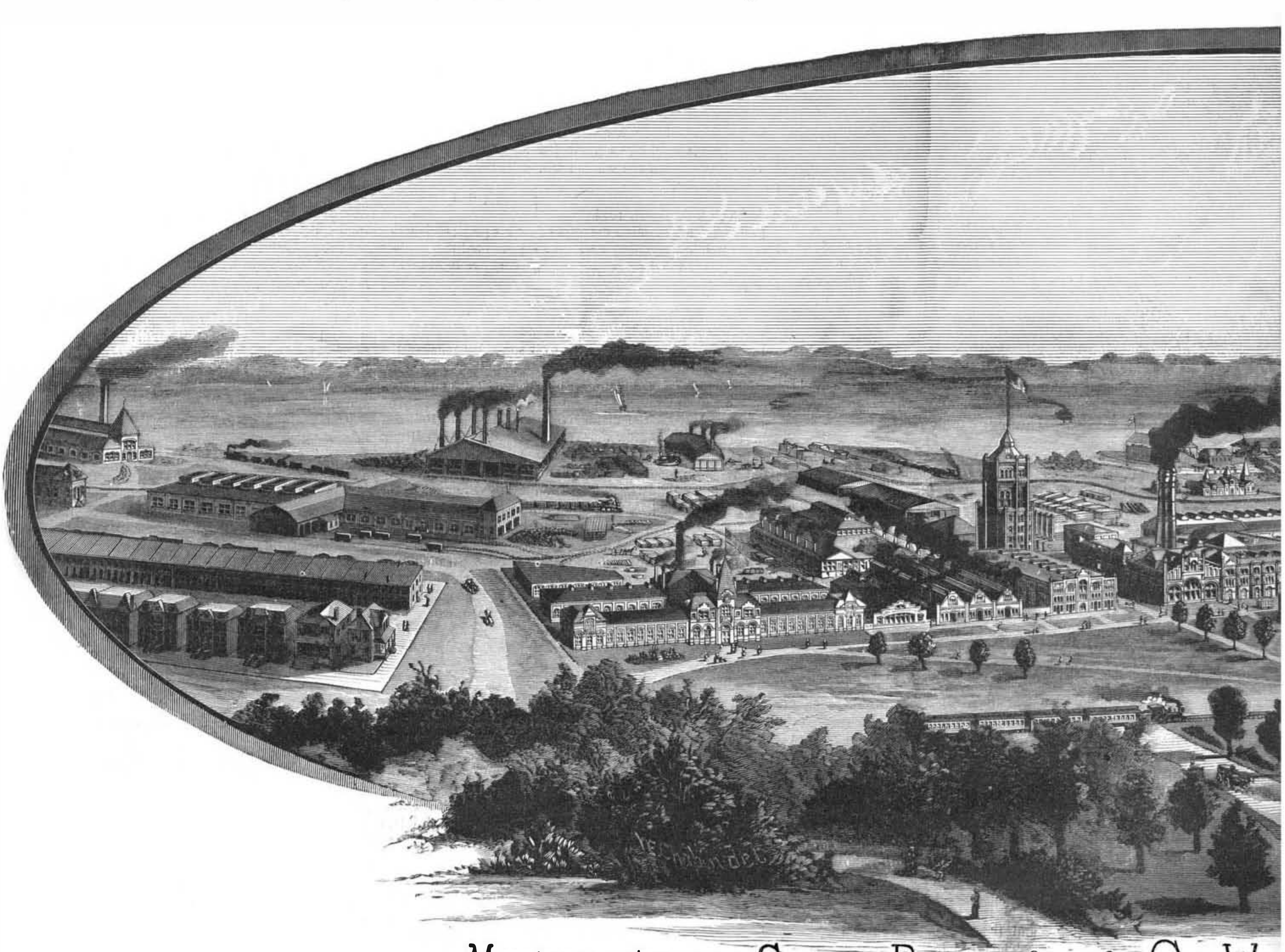
*Spiegeleisen* is a name applied to cast iron containing from 10 to 20 per cent of manganese and about 5 per cent of carbon. As its name indicates, it came originally from Germany, having been at first an accidental product resulting from the working of iron ores that contained manganese. It first began to attract attention about ten years ago.

As long as spiegel was used for making iron in the old way it was of very little value, for, although it produced a superior quality of wrought iron, the expense of puddling was very great. Upon the introduction of the Bessemer process it assumed an importance previously undreamed of, being found to be an indispensable adjunct to that process. It is obtained by the reduction, in a blast furnace, of iron ores containing manganese, if such are to be had, or by mixing a suitable quantity of manganese ore with the iron ore. A high temperature and hot blast is also necessary. If either of the ores contain phosphorus, or if there is any in the fuel or flux, it all passes into the alloy, hence the necessity of a very careful estimation of the phosphorus in the materials employed.

One characteristic of spiegeleisen, to which it owes its name, is its crystalline structure, with large, smooth cleavage planes, that have a tendency to iridescent tarnish.

In making steel by the Bessemer process (that of forcing air through the melted iron), when all the carbon is burned out the metal is found to be quite rotten at a red heat, or "red short." This shortness is removed by the addition of about 8 per cent of spiegeleisen.

*Ferromanganese* is an alloy of 30 to 80 per cent of manganese with iron and only half a per cent of carbon. In Oberhausen the monthly production of 60 per cent ferromanganese is 700 tons



MANUFACTURING CITY OF PULLMAN AND CAR WO

*Manganese bronze.*—In 1876 P. M. Parsons introduced an alloy which he called manganese bronze. Tests made with this metal at the Woolwich Arsenal showed that it possessed remarkable tensile strength, but it seems already to have passed into oblivion.

German silver has also been made with manganese in the following proportions: copper 80 per cent, manganese 15 per cent, zinc 5 per cent. This alloy is white, works easily, and takes a fine polish.

Rousse recommended (in *Comptes Rendus,* xciii., 546) the use of an 85 per cent ferromanganese in place of zinc in the Bunsen battery. A solution of the permanganate of potassium is employed for depolarization, but the manganese salts are easily regenerated and recovered.

The black oxide, or pyrolusite, is used not only for making the above described alloys and in glass making (as a soap), but even more extensively for making chlorine gas. It is mixed with chlorates for making oxygen, or more rarely used alone. Tessie du Motay's oxygen process, in which steam was passed over the oxides of manganese and strong alkali, has not found much practical application. Black oxide of manganese is used in the Leclanche battery, and the consumption is not inconsiderable for this purpose.

By fusion with alkalies, manganates and permanganates are formed that find considerable use in the arts, both in dyeing, as a disinfectant, or for other purposes.

The salts of manganese are distinguished for their beautiful colors, usually some shade of pink. Manganates, however, are green, permanganates deep purple, but change easily.

### AN INDUSTRIAL CITY.—PULLMAN, ILL.

It is not quite four years since that, on the 25th of May, 1880, ground was first broken for the building of the Pullman Palace Car Works and the city of Pullman, Ill. At that time the land was an open and not very promising prairie; the appearance it presents to-day will be, perhaps, better appreciated from a glance at the accompanying illustration than from any description we can give. Yet the building of the city of Pullman, and the success which has marked the scope of the enterprise, represents much more than the making of a great industrial city in a wilderness in a short period of time. It was, pre-eminently, the design of its founder to build a city in which, as far as possible, all that would promote the health, comfort, and convenience of a large working population would be conserved, and many of the evils to which they are ordinarily exposed made impossible, while at the same time conducting the enterprise on thoroughly sound business principles, looking for a moderate and sure return on the capital invested. And it is not yet too early to say that the execution of this comprehensive plan has been attended with a success as great as it has been well deserved.

This young city, which has now almost reached its fourth birthday with a population of over 7,500, is situated on the west shore of Lake Calumet, five or six miles west of Lake Michigan and fourteen miles south of Chicago, on the line of the Illinois Central Railroad. The ground is almost a dead level, as it is, in fact, through most of the State of Illinois, the lake being of a soft bottom ranging from 1 to 8 feet in depth, while it is only 1½ miles wide by 3 miles long. It drains a small area, not much of the land in Pullman being more than 7 or 8 feet above its surface, and it is connected with Lake Michigan by the Calumet River. The latter, however, does not run through the lake, but is connected therewith by a small channel, through which the water flows from the lake to the river, or from the river to the lake, according to the conditions of winds and floods.

In the selection of a site the first great object was to obtain the ownership of a sufficiently large body of land, that the builders of the new city might have room enough in which to develop their plans and protect themselves from objectionable surroundings, while still being in the vicinity of a leading city, and a location thus near the great railway center of the continent presented obvious advantages. The situation is near enough to Chicago to be easily reached in even less time than it takes to travel to any of New York's suburbs from the business portion of the city; but here, with every facility which capital can control of prosecuting their great industrial enterprise, the Pullman Company have the added advantage of a permanent population of skilled labor, bound to the interests of the company by the knowledge that the latter has, with great wisdom and foresight, to leave out the idea of beneficence, shown a practical consideration for their comfort and happiness, of which there is not another similar example in the world to-day.

The industries carried on here, and for which the city has been built, include the Pullman palace car and freight car shops, the Allen paper car wheel works, the Union foundry and Pullman car wheel works, the Dunning steel horseshoe works, the Spanish-American curled hair factory, and other minor manufactures collateral to the principal business and incident to the maintenance of such a large and rapidly growing population. Not the least among the latter should be mentioned the large brick yards of the Pullman Company, as there have been used, besides 25,000 cords of rubble stone, 45,000,000 of brick in the building of the city.

One of the last completed of the large factories is the freight car manufactory, which has an area of 800 feet in length by an average of 200 feet in width, and has a capacity for manufacturing forty freight cars per day, or one for every fifteen minutes in working hours. The total number of workmen employed is about 4,000 in all the departments, the car shops alone keeping 2,500 busy. The power for driving the machinery for the principal shops, as well as the freight car shops, is furnished by the great Centennial Corliss engine, being conveyed to the freight car shops by underground shafting.

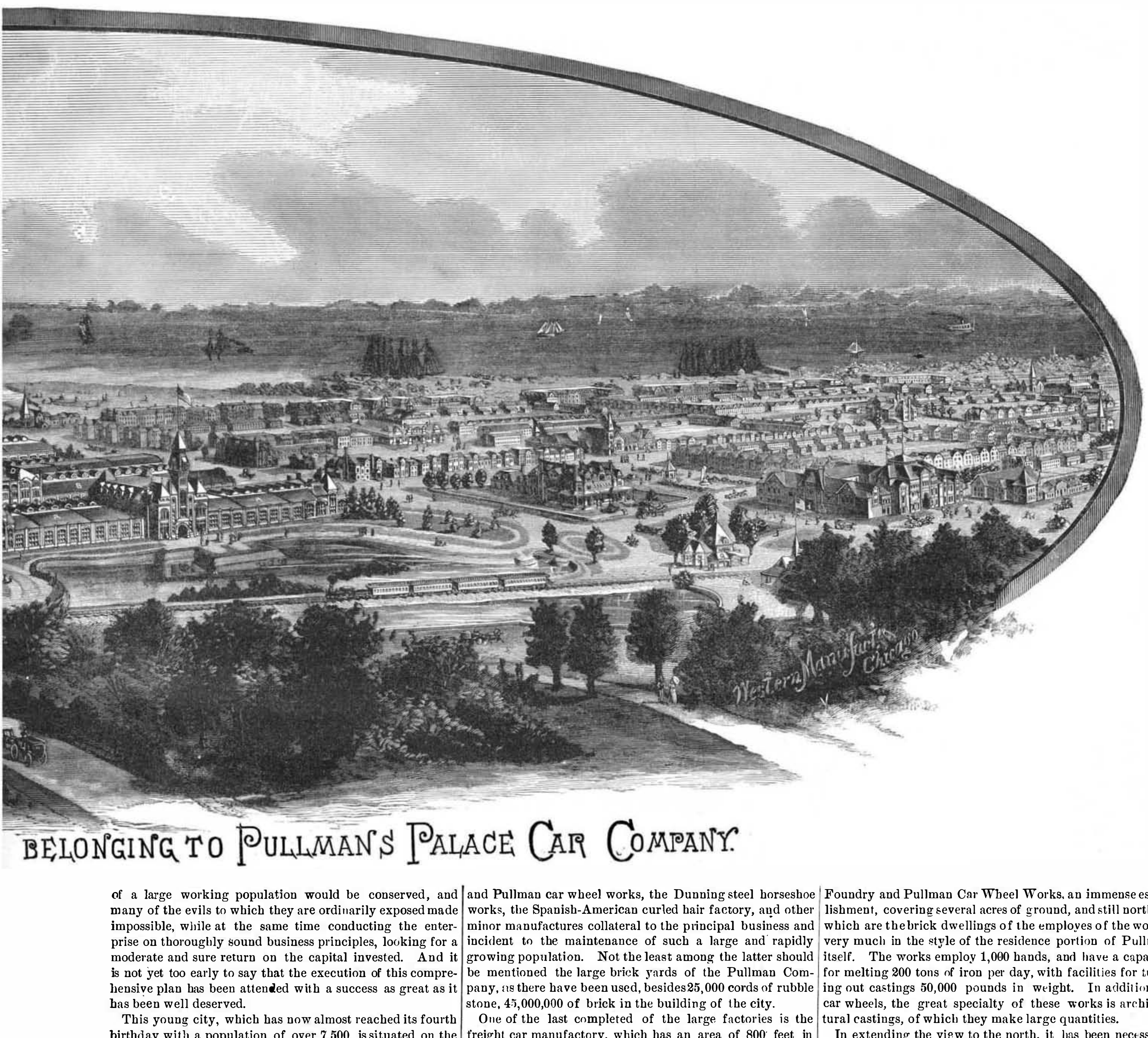
The length of the city from the north to the south end is about two miles, while the width from Calumet Lake back is about one mile, of which the dwellings at present cover over 150 acres, the city having 1,400 brick tenements, houses, and flats. The frontage of buildings extends along five miles of well paved streets, and there are fourteen miles of railroad track laid for the use of the city and shops. The buildings are all of brick or stone, and built in the most substantial manner. The homes of the workmen are upon wide, well paved, and shaded streets, and have all the conveniences of the best modern city houses.

Every house has gas and water, while the larger houses are heated by steam, have hot and cold water, and bath rooms, and the drainage and sewerage is perhaps the most perfect of that of any city similarly located in the world. The æsthetics of architecture and landscaping are also made prominent features, and the grouping of buildings and trees, to produce a pleasing effect, has been studied as diligently as the arrangement of machines in the shops.

At the left in our illustration, and at the north end of the city, are the new freight shops before referred to, and in their immediate vicinity are shown the residences prepared for the workmen in these shops, while a little further in the background may be seen the shops of the Chicago Steel Works, now in full operation. At the extreme left is shown a small portion of the south end of the shops of the Union Foundry and Pullman Car Wheel Works, an immense establishment, covering several acres of ground, and still north of which are the brick dwellings of the employes of the works, very much in the style of the residence portion of Pullman itself. The works employ 1,000 hands, and have a capacity for melting 200 tons of iron per day, with facilities for turning out castings 50,000 pounds in weight. In addition to car wheels, the great specialty of these works is architectural castings, of which they make large quantities.

In extending the view to the north, it has been necessary to omit some important structures of the residence portion, at the south end of the city. Notable among these is the elegant and commodious school building, which has been erected at a cost of $60,000, and is one of the best in the State. It has fourteen commodious school rooms for the various grades, and will seat 850 pupils. Another large building in that vicinity is called the Casino, the first floor of which is devoted to stores, while the second floor contains the rooms of the Episcopal Church, and a large photograph gallery. The other buildings left out are dwellings.

In the center foreground are the principal erecting shops of the Pullman Palace Car Company, the water tower, and the building adjacent containing the great Corliss engine,



BELONGING TO PULLMAN'S PALACE CAR COMPANY.