EDISON'S LATEST TRIUMPH

Operations of a Magnetic Ore Extractor in the Jersey Mountains.

DETAILS OF A WONDERFUL MACHINE

Automatic Machinery Crushes the Rock, Extracts the Ore and Feeds the Furnaces—Great Obstacles Overcome.

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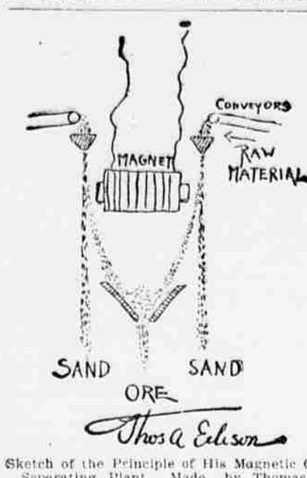
Thomas A. Edison has just completed what may prove to be the greatest achievement of his life. After eight years of incessant work, night and day, in the face of discouragements which seemed almost insurmountable, in spite of obstacles which only a genius could overcome, he has given to the world an industrial invention which in the seriousness of its intention may come to rival the kinetoscope, the phonograph or even the electric light. Nothing he has done heretofore has required so much of his individual attention, taxed his inventive ingenuity so fully, or in the aggregate consumed his vital powers more than this latest accomplishment. Thousands of poor workmen will bless the steadfastness of purpose which made him carry his ideas to a successful issue. He has, in short, at last pointed out a commercial way of utilizing the immense deposits of iron ore which lie under the New Jersey hills.

Billions of tons of iron ore lie scattered though the rocks of the eastern spurs of the Allegheny mountains. Edison himself made this remarkable discovery years ago and geologists ever since have amused themselves with proving how perfectly inexhaustible is the supply. But the ore is scattered about in such fine particles that it could not be mined with the ordinary methods, and hence has been looked upon as one of the few great wastes of nature. This state of affairs was very aggravating in view of the peculiar conditions which prevailed in the iron trade of the extreme east. For some years past the bulk of the Bessemer steel trade has been drifting westward by reason of the discovery and opening up of immense deposits of high-grade ore in the Upper Peninsula of Michigan, suitable for making Bessemer steel, cheaply produced, and carried at small cost by water transportation to furnaces contiguous to the lake ports. The furnaces east of the Alleghanies were compelled to depend on a few small, isolated deposits of Bessemer ore in the east and ores imported from foreign countries. The ore deposits of the southern states, as well as the non-magnetic ores of New Jersey and New York, are unsuitable for making Bessemer steel.



Sketch of the Principle of His Magnetic Ore-Separating Plant, Made by Thomas A. Edison.

For a time the cost of the ore at the eastern furnaces was not greatly different from the cost in the Pittsburg district, but in the last few years the cost of foreign ores, which are approaching exhaustion, has reached the prohibitory point. Then the discovery of the great deposits in the Mesaba range of Minnesota in the last three years, and the tremendous cheapening in the cost of mining and transportation of these deposits, have apparently raised insurmountable obstacles in the way of eastern iron mills meeting the competition of the great mills of the central west, even in the eastern market, and many mills have ceased to operate. The condition is not a trivial one, for many thousands of persons depend upon these mills and furnaces for a living.

THE DISCOVERY.

Edison's interest in the matter dated from a romantic episode which occurred sixteen years ago. He was walking along the seashore on Long Island one day when he noticed a strange pile of black sand piled high up on the beach. He had never seen such remarkable sand. He examined it, sifted it and even tasted it, but he could find no reason for its inky hue. With the zeal of the scientific investigator, he carried some of it home to his laboratory for the purpose of testing it. He was on the point of putting it aside when suddenly he became possessed of an idea. He procured an electro-magnet and held it near the mass. Immediately little dark grains separated themselves from the heap and scurried across like so many black ants to the spot over which the magnet was held.

The little ants were really grains of iron ore and, strange as it may seem, Edison had discovered a bed of finely divided iron ore cast up by the sea. This sand covered the shore in spots for fifteen miles along the coast. It was due to the erosion of Connecticut rocks by water, for magnetite is one of the constituents of the primal rocks found in Connecticut. Edison calculated that the deposits must contain millions of tons of iron which, if it could be smelted, would become a valuable product. On the basis of his find he evolved his famous magnetic-ore separating machine, which he exhibited at the last Paris exposition. Then he let out the privilege of using it to a contractor who set up a plant on the beach and proceeded to separate the iron ore from the sand with every prospect of developing an extensive industry. But the sea proved to be less generous than it had at first promised to be, for one dark night there came a storm such as had not visited the place for many years and when the contractor came to visit his plant the next morning, not a vestige of the black sand remained. It had all been swept into the sea from whence it came.

When the above mentioned curious condition of affairs in the iron trade was brought to Mr. Edison's attention, eight years ago, he thought of the ill-fated Long Island enterprise and of his discarded magnetic separator, and wondered if it might not in the end present a true solution of the difficulty. In order to assure himself of the exact condition of the iron mines in the east, he made a tour of the mines in New Jersey, for the purpose of seeing how much ore there was left in them and how long it would last. It was on this memorable trip that he made the discovery that most of the rocks of New Jersey were underlain with immense deposits of iron. He invented a magnetic needle which would "dip" towards the earth whenever it was brought over a large deposit of iron ore.

A NEEDLE POINTER.

He was driving along in a buggy one day between two mines. The needle was on his lap and his mind was drifting away from the subject in hand, when suddenly he noticed the point of the needle dip violently toward the earth, and remain pointing downward. He wondered how this could be, for, as far as he knew, there was no iron ore anywhere near him. He tested the needle and found it all right. He was driving over gneiss rock at the time, and he noticed that whenever he was above this rock the needle continued to point towards the earth. His amazement became great, for if the needle did not err, it simply meant that the ground under him was underlaid with immense deposits of iron. Determining to find out if this was so, he set a corps of men at work making a magnetic survey of the rocks of New Jersey. He then planned a magnetic survey of the whole east, and it remains probably the most comprehensive undertakings of its kind ever accomplished.

With his magnetic needle, or, as he calls it, his "magnetic eye," he tested every large body of gneiss rock extending along the eastern coast of the United States, from lower Canada to the great Smoky mountains of North Carolina. He found immense deposits of iron. For instance, in the 3,000 acres immediately surrounding the village of Edison there are over 200,000,000 tons of low grade ore. In the entire district there are 16,000 acres in which the deposit is proportionately as large. The world's annual output of iron ore does not, at the present time, reach 60,000,000 tons, so that in the paltry two miles surrounding the village of Edison there is enough iron ore in the rocks to keep the whole world supplied for one year or the United States for three years, even with the natural increase in demand. Sixteen thousand acres, or twenty-five square miles of land, contain enough iron ore to keep the whole world supplied for seventeen years, allowing, of course, for all natural increase of demand due to the needs of a growing population. These acres would more than supply the United States with iron, including necessary exports, for the next seventy years, and they contain more than has been mined heretofore in this country since its discovery.

This was a remarkable condition—smelting works shutting down for want of iron ore at low prices when billions of tons of it lay idle in a strip of land which in most cases was within seventy-five miles of the great iron mills of the Atlantic coast. Here was an opportunity of which the inventor immediately took advantage. He set to work to plan out a great industry. It has taken him eight years to do it, but the result has justified all the trouble and money which he has expended upon it. Engineers used to large enterprises of the kind have smiled incredulously. Some of them have spoken of it as Edison's hobby and others as his folly. Some have shown him on paper that no machine could be constructed powerful enough to crush five, six and seven-ton rocks, or if such a machine were constructed it would never stand the jar and strain exerted upon it. This particular difficulty, it may be said in passing, Mr. Edison surmounted so completely that less than 100-horse power is required to reduce rocks weighing six and seven tons to dust in three seconds from the time they are thrown into the crushing machine. Other difficulties were overcome as completely, none proving too much for Mr. Edison's indomitable will and rare concentration of mind and energy.

HOW EDISON LEVELS MOUNTAINS.

Yet, after all, he has accomplished a very simple thing. He is crushing rocks and dropping the resulting powder past powerful electro-magnets. The sand is not attracted by the magnetism and passes straight on, the iron ore is attracted to one side and falls in a heap of its own. This is the whole principle, yet in the actual working out it

The village of Edison stands on the summit of Mount Musconetcong, in northern New Jersey. The spot is 1,200 feet above the level of the sea, and is the center of a dense wilderness. One's first view of the place is apt to be tempered by the disagreeable white dust which flies through the air and overlies everything. The activity roundabout is in strong contrast to the placid country district through which one must travel in order to reach the place. On all sides the roar and whistle of machinery, the whirr of conveyors and the general noise and bustle, proclaim this to be some quite extraordinary enterprise. The workmen look like millers, so coated do their clothes become with the flying white particles, and every one wears a patent muzzle in order to circumvent the bad effects which the dust would otherwise have upon the lungs.

Some of the buildings are as tall and narrow as city "sky-scrapers;" others are flat and squatty, covering considerable areas. Big wheels revolve in the engine house and ten tons of free rock a minute, the local activity is tremendous. Flat cars carrying two skips each, move along at lively speed. A long line of them is constantly leading up to the crushing plant, where big electric cranes rid them of their load and a little switching engine pushes them around a loop and allows them to run down an incline into the cut again.

MAKING A YOSEMITE OF HIS OWN.

Edison is found watching the steam shovel. "We are making a Yosemite of our own here. We will soon have one of the biggest artificial canyons in the world." This remark is occasioned by the fact that the steam shovel is working three-quarters of a mile from the works proper. It is somewhat down the hillside, but it is eating its way on a level straight into the hill.

"It will take us a year to reach the mills, but when we do get that far in we will have a trench with walls 100 feet deep. I suppose we will take out over 600,000 tons of rock before we get there. Then when the trench is completed we can blast off the walls with dynamite, taking off 32,000 tons at a time."

As intimated above, the ore bearing rock is blasted into boulders and then laid on flat cars with a steam shovel. It is then conveyed to the crushing plant. The cars are run in under each end of the crushing mill. The trays containing the rock are lifted by the cranes to the second story of the mill, where the rock is dumped into a large square pit. Ten feet below the edge of the pit revolve immense iron rollers weighing 100 tons. The surface of these rollers is studded with teeth, and the space between them is less than a foot wide. Nevertheless a six-ton rock dropped into the pit passes between the rolls in less than three seconds. Far down beneath these rolls is another set of similar size, but nearer together. From the heavy rolls above the rock falls into this lower set and is crushed still smaller. It has now been reduced to pieces the size of a man's fist and from the lower set of rolls drops into an elevator or endless conveyor, which carries the pieces up to the top of another part of the building and dumps them into a shaft leading down to three more sets of rolls, directly beneath one another. As the rock passes through these rolls the latter are found to be placed nearer and nearer together until with the last or third set the two rolls composing it are set tightly against each other, so that when the rock ultimately passes through it has been reduced to dust.

One of the remarkable features of this immense crushing plant is that the crushing done by the largest, or what are known as "Edison" as the giant rolls, is not the direct result of the energy of the steam engine. The rock is really crushed by momentum. For instance, the engine which operates the 100-ton rolls is of less than 100-horse power. It has just power enough to cause the big rolls to revolve at terrific speed, but more than this it cannot do. If any obstruction—a rock for instance—should come between the rolls, a patent clutch by which the engine is connected to the rolls at once causes the engine to let go its hold. The momentum of the rolls, however, carries them around, and the rock is crushed by this stored up energy. The same energy if applied directly from the engine would necessarily have to be much greater than it is, and at the same time the shock of the obstruction coming between the rolls would jar the engine to pieces in a short time. In fact, it may be said that the work of ore separation would not be a commercial success were it not for the utilization of three natural forces—momentum, magnetism and gravity; momentum to crush the rocks, gravity to take the place of expensive machinery in separating the ore, and magnetism to draw the fine particles of ore from the sand.

A MILE OF MAGNET FACES.

One of the features of "Edison," the place, is the great number of endless chain elevators which connect the buildings with one another. As the ore passes through each building it is carried on to the next automatically in these endless elevators. After it leaves the crushing plant it is carried to the top of the magnet house and dumped into space, to find its way through many sieves of varying meshes and past many magnet faces of varying strength before it ultimately falls in the cellar of the building and into another elevator which carries the greatly changed product to the next department. There is over a mile of magnet faces in the nearest magnet house. The ore drops down through long chutes. On the way down it passes the magnet faces. Directly under each magnet face is a side chute leading off in a direction of its own and directly above each magnet face is a sieve. As the ore comes down, if fine enough to pass through the sieve it continues its course; if not, it rolls off the sieve into a chute at the bottom of which there is a conveyor, which carries it back to the rolls to be re-crushed. If the product goes through the sieve the magnet draws the ore from the sand, passing straight down to an elevator which carries it out of the building and dumps it onto a huge sand pile.

The falling sand presents a very beautiful sight. A stream of it, shimmering and shining in the sunlight, descends and mixes with the great cone already piled up beneath. Nothing could be more beautiful than this gorgeous cataract of powdered rock falling like a veil, and noiselessly adding to the great mass below. Nor is it a useless accumulation. It is sold for various purposes to builders and manufacturers, who seek it more eagerly than they do the sand of the seashore or of the bank. Seashore or bank sand has, in the course of centuries, lost its edges, because the particles have constantly rubbed against one another. Broken rock sand, however, is very sharp, and for cement and lime-work is very desirable.

SIXTY-SIX HUNDRED EXPERIMENTS.

The pure ore is now allowed to drop downward and pass through a room where blowers rid it of any dust which may have accompanied it on its travels. After leaving the blower room it is really a stream of pure, finely divided iron ore, which drops into conveyors and is carried to a store house which holds 5,000 tons. Here it may rest temporarily, or it may pass on by means of other conveyors to the mixing house. It cannot be smelted in the form of iron dust. The force of the blast would blow it from the furnaces. It must be made into briquettes, and in order to do this it must be mixed with some adhesive substance which will prevent it from disintegrating when brought under the action of the furnace. The mixing machines are huge cylinders in which operate great iron paddles. The ore is fed into the cylinder from the top, and the adhesive material (the nature of which is a secret with Mr. Edison) drops also from above, and the whole mass is churned together until every particle of the ore has come in contact with a due proportion of the adhesive substance. It becomes, in fact, a sticky mass which is pushed out of one end of the cylinder and conveyed away to the bricking house to be made into little briquettes. It may be said in passing, inasmuch as it throws a sidelight on the character of the great inventor, that Mr. Edison performed over 6,600 experiments before he struck upon the right adhesive material for use in binding the ore together.

The bricking machines are simple looking affairs and, for the purpose of comparison, may be said to be just as simple in their appearance as is the incandescent lamp. Like the latter, however, they passed through a multitude of changes before their final form was agreed upon. As is usually the case with inventions of the kind, this final form is probably the simplest that could be devised, and in view of the cumbrous machines which were constructed and discarded in the course of the evolution one wonders that this form was not thought of at once.

The ore drops into a small orifice in the cylinder. The cylinder then turns so that the hole comes forward and exerts thousands of pounds pressure on the ore, the cylinder then turns downward and the newly made briquette drops out from the hole and falls into another endless conveyor, and is carried forward into a large oven, to be baked. There are thirty bricking machines and fifteen ovens in the plant and a continual stream of briquettes is circulated through the hot air chambers of these ovens. The conveyors travel five times around the interior of the oven before the briquettes reappear. When they come out they have undergone a change which makes them a commercial product. For instance, they will now absorb gases in the furnace which they are required to do; but they will not absorb water. This condition is necessary so that they may be shipped to the furnaces in open cars. If a stream of water were allowed to flow on a brick, the water would simply run off; on the other hand, if alcohol were dropped on it, it would instantly be absorbed by the brick. This was the point for which Mr. Edison was striving when he made his sixty-six hundred experiments.

WONDERFUL AUTOMATIC ACTION.

From the oven the bricks are conveyed to the railroad, where long trains of freight cars await them. The conveyor at this point extends out over the track, and the engineer of a train has simply to back his cars underneath the mouth of the conveyor. The bricks drop out and the cars load themselves. In fact, this automatic action is the great feature of the plant. From the time the ore is blasted with its native rock out of the mountain-side until it is loaded in the form of commercial pure iron briquettes on the cars, it is not touched by human hands. The never ending and never-resting steam of material constantly circulates through the various buildings, crushed by the stored momentum of gigantic rolls; hoisted skyward by steam; pulled earthward by gravity; deflected by magnetism; dried, sifted, weighed, gauged, conveyed; changed from rock into dust, and from dust into comprehensive lumps, mixed with a due proportion of adhesive material; churned, baked counted, and sent flying to the furnaces by fast freight; and not once in its course it is arrested or jogged onward by human agency.

Only 145 attendants are required to operate the plant, and these men are after all merely watchers, to see that the machinery does not get out of order. The crushing capacity of the Edison plant is more than 20 per cent greater than the combined crushing capacity of all the stamp mills of California. The long mile of magnet faces has enough pulling power to tear a modern cannon from its stanchions, and the great steam shovel can clean out more rock from the mountain-side in a given time than any other like piece of mechanism in the world. Yet all these great affairs seem as nothing to the masterful control of the man who planned it all. Edison moves about among his men with not the slightest consciousness of having done anything great. It will be but a question of time when the little plant on the hilltop will be the center of the great iron industry of the east. The pockets of ore from which the United States has drawn its chief supply are rapidly becoming exhausted. There is, it must be understood, plenty of iron ore in the country, but it is not the kind of ore from which steel can be made. Steel can only be made from ores in which the per cent of phosphorus is very small. Edison, with his crushing process, has entirely eliminated the phosphorus element from the ore. It therefore remains inevitable that this must ultimately become the only serious method of producing ores from which steel will be made. It would seem from the prospect that Edison will become the head of a vast industry, as great as that brought into existence by the invention of the incandescent light, and in a measure more imposing, as it embraces the production of what in commercial circles is after all the most valuable metal on earth. In spite of this, however, the man who planned it all does not from his demeanor appear to have been over-impressed with its importance. His position in the matter is well summed up by Mr. W. S. Mallory, his second in command.

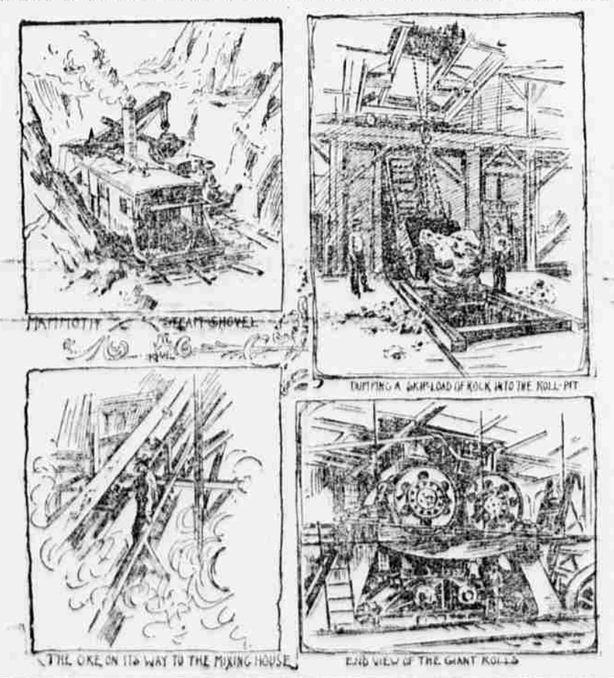
EDISON'S ATTITUDE IN THE MATTER.

"I want to say," says Mr. Mallory, "and I know whereof I speak, for I have been with him night and day for several years, that 95 per cent of the credit of all the invention and new work of this establishment is due personally to Mr. Edison. I have heard it stated that Mr. Edison is an organizer for the brains of other men. Nothing could be further from the truth than this. If this place was preserved as a monument for him, his memory would be placed upon no false pedestal. I have seen him by night and by day, in all weathers, and under all conditions, and I have found him always the same, the personification of concentration of purpose, and with a long-distance judgment at his beck and call which, however strained it may seem at the time, we have all learned to respect as being sure to prove right in the end. And what has been said of his personal magnetism has not been overstated. I doubt if there is another living for whom his men would do as much. I suppose it is the power of example. We have here many men who have left well-kept homes to come up into the backwoods and toil day and night mainly out of loyalty to Mr. Edison. The fact that the 'Old Man' does it seems to be sufficient reason for them to do it; for what is good enough for the 'Old Man' is good enough for them. This, at least, is the spirit that prevails."

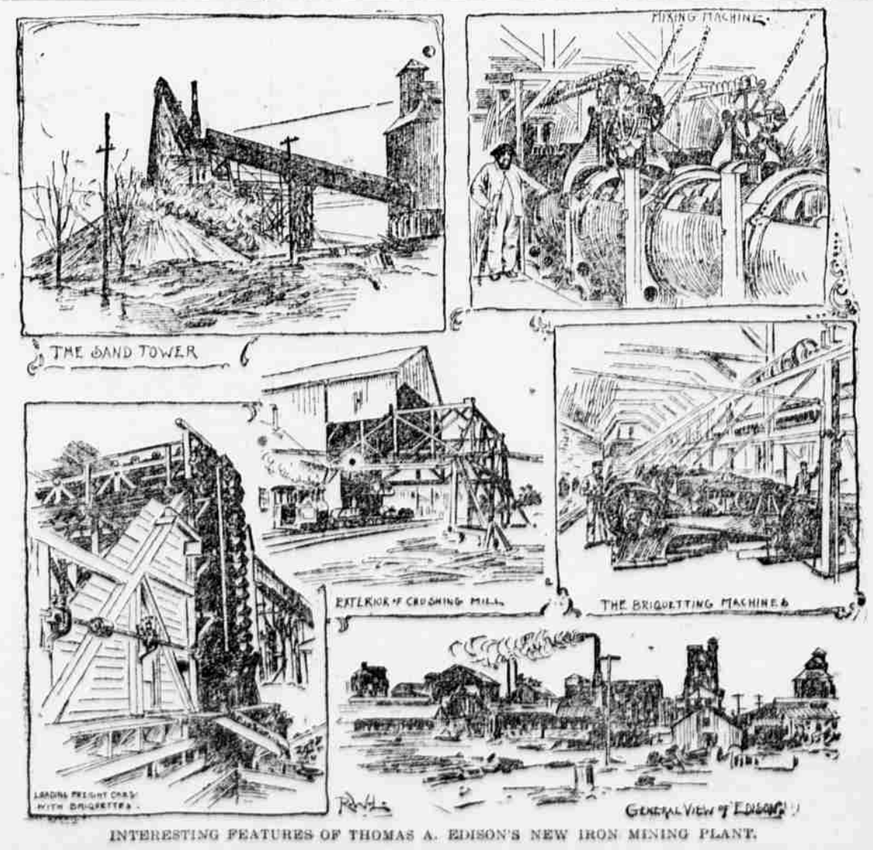
That this is the spirit which pervades the community can be easily seen by any one who visits the place. Up on the hilltop, in the shanties of Summerville, dwell laborers of the poorer class. Far over on the other side of the mine stands the "White House." It is a little dwelling in which Edison lives with his chief men. At intermediate spots stand the shanties in which live the workmen of the intermediate class. But from all of these dwellings comes a reverence for the master which is quite as strong and healthy in one place as in the other. As he moves among them all, none of them can have a true conception of the great things he is constantly planning, but they all know it is for their good and for the good of the world at large. No man has done more than Edison to benefit his generation. He essentially is the man of his time. Other men may do great things in the time to come, but whatever these things may be they can never create more radical changes in the conduct of human life than have Edison's inventions. His old duster and his oldest straw hat can be seen flitting hither and thither about the works, their owner apparently intent upon nothing out of the ordinary; but the constant suggestions which he makes to the heads of the various departments show that the wonderful brain is never inactive. The present enterprise was planned years ago, and now that it is finally completed, Mr. Edison's mind will revert to even greater schemes of conquest; and at this moment it is safe to say that he is planning out some great achievement which will take the world more by storm than have the great things he has already accomplished.

THEODORE WATERS.

HOW ORE IS EXTRACTED FROM THE MOUNTAINSIDE IN EDISON'S IRON MINE.



THOMAS A. EDISON AND WILLIAM S. MALLORY.
(From a Photograph Taken in "Edison," N. J.)



INTERESTING FEATURES OF THOMAS A. EDISON'S NEW IRON MINING PLANT.

FIND PROFIT IN SEIGNIORAGE.

Counterfeiters Make Better Dollars Than the Government.

ST. LOUIS, Oct. 30.—Counterfeit silver dollars of greater weight and fineness than those turned out from Uncle Sam's mints are the latest, and St. Louis is the first city to suffer from them. For the last week St. Louis bank tellers have been accepting the counterfeits in question without hesitation. It was only when they reached the St. Louis subtreasury that their spurious character was detected. United States Treasurer Small sent one to the director of the mint for assay. He received a reply in which the statement was made that, although the assay had not been completed, there was no doubt that there was more pure silver in the counterfeit than in a genuine coin, and that its fineness exceeded that of the genuine. According to Colonel Small, the coins weight 13½ grains more than the genuine, which weighs 412½ grains. Its fineness is 94 per cent, while that of the genuine is but 90 per cent.

Highwayman Killed His Companion.

AURORA, Ill., Oct. 30.—Peter Braun, a merchant of this city, was shot and instantly killed late last night by a highwayman. Two thugs attacked Mr. Braun and in the scuffle one of them sent a bullet through his partner's body also, ending his life. Seeing his mistake he fled without taking the proceeds of the day's business from the pockets of Mr. Braun. The dead highwayman has not been identified.