

HOW EDISON INVENTED THE ELECTRIC LIGHT.

The Wizard Tells How He Made the First Incandescent Lamp with a Vacuum Pump and a Piece of Cotton Thread.

NEW YORK, June 24.—Thomas A. Edison made the first modern incandescent lamp out of a vacuum pump and a piece of cotton thread. The idea of the bamboo filament was given to him by a palm-leaf fan. Here is his story of the invention, which created a new industry and revolutionized the lighting effects of the world:

"The subject of electric lighting occupied my attention at intervals from a very early period of my life," says Mr. Edison. "As early as 1864 I commenced to experiment in this field. But no material advance had been made in the production of incandescent lamps for more than a quarter of a century previous to my taking up the subject. No lamps had been made that were capable of practical use, nor had the conditions of use of a practical incandescent lamp been determined, nor had any comprehensive system been devised whereby practical lamps of small candle-power could be used in supplanting or competing with gas as a general illuminant. Experimenters had used platinum burners, but there were many objections to their use. I turned my attention to platinum and made many experiments with it, working with the idea that something might be evolved if the metal were coated with earthy materials. During these experiments I made a remarkable discovery. I found that it was much harder to melt platinum in a vacuum than when it was exposed to the air. It would stand more electric current, and its illuminating powers were greater. This knowledge opened the door to the later discoveries. I tested the melting point of many substances under the vacuum pump, and with the idea of increasing the good effects of the platinum experiment I sought to obtain a more perfect vacuum.

"I tried a series of experiments with carbonized paper to determine its availability as a light for an incandescent lamp. I placed strips of carbonized paper in the electric circuit and brought them up to incandescence in the open air. I also placed carbon strips in the air pump in which the atmosphere had been exhausted and brought the strips to incandescence. From these experiments it was absolutely certain that an incandescent lamp was possible, but to make it commercial it was necessary to perfect it in parts. During 1878 the work was interrupted because my time and attention were absorbed by the invention and exhibition of the phonograph. My health broke down, and I was compelled to go West to recuperate. On my return, in August, 1878, I resumed my experiments, and continued them night and day. I tried paper, coated with tar and lamp black and carbonized, holding it in lamps connected in circuit and placed under a vacuum pump. I also tried carbonized broom corn. The knowledge obtained by me that the passage of a current through platinum, during the process of exhausting a chamber in which it was contained, would drive out occluded gas, and thereby increase the infusibility of the burner, led me to aim at securing greater perfection in the vacuum, upon the theory that the higher the vacuum in which was carried on the process of treating the platinum, the higher would be the infusibility of the burner resulting from such treatment. About August, 1879, we obtained a vacuum pump which would produce a vacuum up to the 1,000,000th part of an atmosphere.

"Having this entire glass chamber exhausted to the one-millionth of an atmosphere, it occurred to me to try a comparatively short filament of carbon. So, on the 21st of October, 1879, I introduced a carbonized cotton sewing thread. It was a loop of horseshoe form. With this lamp I made the discovery that the filament of carbon under the conditions of high vacuum was stable and would stand high temperature without disintegration or oxidation, which took place in our previous attempts. I knew that through this discovery I had ascertained the conditions for the production of a successful incandescent lamp. Up to that time I had spent in money about \$10,000, but the discovery that I made, surprising as it was to me at the time, enabled me immediately to determine that very fine filaments of carbon with high resistance, could be used as incandescent conductors for electric lighting by a system of multiple arc distributors. It was also proved from the fact that the filament of carbon, being small in cross section, did not conduct heat any better than electricity, and therefore very little heat was given over from the glowing incandescent conductor to the clamps and appliances which supported them, hence no special appliances were necessary to get rid of the heat conduction. Prior to my discovery of the stability of carbon in a high vacuum the direction of improvement in incandescent lighting was not toward a reduction in size of the cross section of the carbon burner. The extreme fragility of carbon in small masses would be consumed on the passage of the electric current through them, deterred inventors from experimenting with them. My discovery for the first time informed the world of properties not before known or supposed to be inherent in carbon, that is, the property of stability in a high vacuum.

"Following the discovery made with the carbonized cotton thread I immediately commenced to use carbon in other forms, and prior to January 1, 1880, I had made several hundred lamps, employing carbonized paper in the form of a horseshoe as the incandescent burner. These lamps were publicly exhibited during the holiday season of 1879 and 1880 in lighting up the streets and some buildings in Menlo Park, including my laboratory and office and two or three houses. On New Year's eve, 1879, about 3000 people visited Menlo park and inspected

the lamps. I equipped and lighted up a steamship, the Columbia, with about seventy-five to 1000 lamps containing paper carbons, which continued to light the ship satisfactorily for several months.

"But while this was to a certain extent a triumph, we had not really produced a commercial article. We had a successful lamp built on the right principle, but it was not economic. It was fragile and costly. In fact, our carbons were apparently not made of the right substance. Somewhere in the world we thought there must exist a substance which could be turned into carbon which would be cheap and lasting.

"One hot day, when discouragements seemed heaped upon us more than usual, I noticed an old palm leaf fan lying upon a table. I picked it up, and on examining it I found that the outer rim was made of bamboo, apparently cut from the outer edge of a very long strip. I gave this to one of my assistants and told him to cut it up and get out all the blanks he could from it and carbonize them and put them in lamps, and turn on the current to ascertain their availability. We were surprised to find that these lamps were several times better than any we had succeeded in making. By a microscopic examination and by other experiments we ascertained the reason why, and I felt so convinced that we had got on the right track that after a short while I despatched a man to China to make an investigation and send me samples of all the different qualities of bamboo that he might find there. He sent me about forty different varieties of bamboo, in such quantities as to enable me to make a number of lamps of good quality. He then made further investigations to ascertain the best persons to furnish and continue to supply us, bamboo raising being an industry in Japan.

"From that time I got my supply of bamboo from the same place. However, I kept up my search for different qualities of bamboo which might prove better, and also for the best of other material. I should say that I received and carbonized, made into lamps and tested their enduring qualities, not less than 6000 different species of vegetable growths. Only about three species of bamboo and one species of a cane which grows in a region of the Amazon, but of which I have never been able to procure a supply owing to the malaria and fevers there, and one or two species of fibers from the agave family, have been found at all suitable for the purposes.

"Yet although we now had the incandescent lamp practically perfect, there were some side issues which unless controlled, might prevent its commercial use. In the first place, the lamps could not be used unless some method could be devised for supplying them with current. The force of the dynamo could not be used to furnish these fine resisting filaments with current in series. It was necessary, in other words, to divide the electric current. There was a general scientific opinion that it could not be done.

"It was not only necessary that the lamp should give light, but the lamps must be adapted to the current of the dynamo and the dynamo must be constructed to give the character of current required by the lamps, and likewise all parts of the system must be constructed with reference to all other parts, since, in one sense, all the parts form one machine and the connection between the parts are electrical instead of mechanical. The first thing necessary to be done was to adopt a fundamentally correct system of distributing the electric current. The essentials of a comprehensive system of electrical illumination similar to the general plan of illumination by gas, with a network of conductors all connected together, is that in a certain area the lights can be fed with electricity from several directions, thus eliminating the distribution in any particular direction. In fact, I had set out to found an entirely new industry and art.

"After many experiments this was accomplished, but then I found that only the men of my laboratory had the first inkling of what it was all about. As I have said, the art was an entirely new one, and there were no factories established at that time in which could be undertaken the manufacture of apparatus. There was no body of skilled artisans who could undertake the work of installing an electric light system, and the necessary establishing of factories, together with the inventing and devising of numerous tools and methods of manufacture. Hence the education of men in the manufacturing of the new character of apparatus was the cause of great delay in the introduction of my system. The experimental work has been carried on in my laboratory and machine shop at Menlo Park until 1890, but I was then obliged to establish separate works for making the lamps, as there was no factory where they could be made, nor was there any skilled class of labor which could have made such lamps without any personal instruction or the instruction of my assistants.

"I was compelled to form a construction department and I personally undertook the construction and installation of central station plants. I gave this construction department my personal attention. I gathered around me a body of men whom I instructed in the details of my system. In my shops I established training departments, so that the men I employed could become familiar with the apparatus that was to be used and generally familiar with all arrangements of the business, to the end that they might be able to superintend the installation of plants. I also opened night schools, where with the blackboard and by actually doing and explaining the thing, the workmen were trained. I prepared catalogues on dynamos and meters and other forms of my apparatus for the use of my workmen. I expended \$54,000 of my own money in

educating men in the construction department of my shops, so as to develop and start this new business. There has been no substantial departure from the methods which I suggested at that time. All incandescent lamps which have been made for commercial use down to the present time have been in substantial features copies of the lamp which was invented by means of a vacuum pump and a piece of sewing thread."

NOTES OF A BYSTANDER.

Editor Statesman:

Probably no entire stranger who ever visited Salem found such unanimous and universal friendship as Mr. F. S. Garretson, who arrived here a few evenings ago. The explanation is not entirely in the fact that Mr. Garretson looks very much like Dewey, or at least like the pictures of the great admiral, nor yet because of the very gentlemanly manners of our visitor. The explanation is largely in the fact that Mr. Garretson comes with a commission from the Secretary of the Treasury to examine the various sites offered for the government postoffice building here—and the understanding that the report of this trusted and experienced agent of that department will about settle the question of location. Mr. Garretson has, however, been very much pleased with his callers, and he has been delighted with his walks and drives over the city. He likes Salem, and Salem seems to like him. He wants to do the square thing—to recommend the location that will please the greatest number of people, and at the same time best accommodate the future growth of Oregon's Capital City.

They're off to Rome and Paris, The great ones of the East, And, down by ocean's borders Rich Webfoot for their feast; The learned with their Chautauquus, The idle with their ease, Are gone to spring and mountain Or to the sad sea's breeze.

But here in dusty Salem The small boy out of school Skins off his scanty garments And dives into the pool— Into the cooling waters Of mill-pond's sluggish slough; No king has grander picnic, Say I; don't you, don't you?

They emulate the Kansan Who swam for glory through The tropic Luzon river— Let honor be his due! But Funston brave nor Dewey, Nor any living man, More fun can have or better Than boy in swimming can.

There is growing to be more civilization among the cattle ranges and the sheep ranches on the bunch-grass and sage-brush wastes of Southeastern Oregon than there used to be. Only a few years ago Peter French was killed by a man out there. Peter French represented capital and prosperity, though he was not personally very rich. The man who killed him represented envy and jealousy—the envy and jealousy that hates prosperity or excellence in others. His head came up to a peak. But envy and jealousy was in the majority in that country then. The murderer had a face of a trial, and his neighbors threw bouquets at him after he was triumphantly acquitted. The magistrate had shaken hands with him after placing him under bonds. But the pecked-pated murderer soon ran away from his crippled wife and dependent children, with another woman, and the people there were sorry they had not hanged him while they had a chance. They now begin to remember that Peter French was a gentleman and a brave man, and that he was good to the men who worked for him. They are sorry for their action. It was a good lesson for them. And then more of them are growing prosperous, and so they are getting over their envy for men who work and manage tags and accumulate, or appear to accumulate—for the fact is that half the men reputed to be rich are not rich at all. They are just ambitious and will go to risk their labor and capital, which is only a form of accumulated labor, of themselves if they have it, or of others if they borrow it or are allowed to make use of it. They are the useful members of society. They work and save and wear themselves out, and the most of the good they do is in furnishing opportunities for others. No man ever yet started out to make this world better without having on his back a lot of envious fellows who wanted to crucify him.

While the Canadian editors were visiting in Portland a few days ago they received a dispatch from a friend at home whose health they had been drinking, cautioning them that if they kept on drinking his health they might run their own.

A traveling man was telling some friends in a neighboring town, a few days ago, that Salem is all right. He said he, "The farmers up here have something to sell when they come to town. They raise something around there that is in demand in the markets; in fact, a good many things. They raise things in large quantities, according to approved methods. This suits money in the jeans of the farmers, and they have something to spend in the employment of labor and for the luxuries and necessities of life. The whole community according has a thrifty appearance. It looks as if it had something back of it. Its prosperity is not all in the future, though the fact is there is bound to be a great deal of growth yet, spread over a long period of years. It is going to be gradual. Why, the people up there are painting their houses and fixing up their lawns. They are doing something, and acting as if they liked the country and expected to live and die there. That's the sort of a country it like. Salem is the sweetest town in the state to do business. No feverish rush or excitement there. Just a steady,

reliable gait." These are compliments of no doubtful character.

The unobscuring man who comes to Salem is liable to overlook an innumerable list of small firms that are in actual existence and doing a prosperous business here. I refer to the "pin stores," one or more of which may be found at nearly every home in the city that has a small boy, or several ditto. The firm names are often very fantastic. There are a good many "Brothers" and "Companies," and very few silent partners. They deal in cigar boxes, shoe boxes, candy, nuts, dry goods and groceries, notions, etc., etc. The larger business men of Salem have been drawn upon very extensively for the empty boxes that help to make up the stocks of these pin stores. The proprietors of the small store often advertise bargain days of various kinds and clearance sales, and there are occasionally bankrupt stocks bought up by the firms next door or on the next block. There is, in fact, a very brisk business carried on by these stores. Side lines have been established in some cases, in the way of circus performances, theatricals, etc., and drug stores have been opened, also hotels and lunch counters especially have sprung up and flourished. Paints and oils are also kept, and the paints are tried on front and back doors and fences, the tests being made in pursuance of an honest effort to sell nothing but approved articles—ar. honesty of effort that finds scant approval from the material and paternal parents in some cases. I have heard of credit being given by some of the little pin merchants, and in at least one case burglars broke in and stole the major portion of a stock of goods, and carried the plunder away, probably being intent on setting up an opposition store. The business life of the pin stores was running along very smoothly until within the past few days. Pins had been the universal medium of exchange. There was absolute free coinage—from the papers and cushions of the indulgent mammas and sisters of the city. The "crime of 1873" had never been thought of. The universal measure and standard of value was apparently entirely satisfactory. But there was trouble one day last week. A small boy who had access to his father's nail keg introduced nail currency into circulation. The trouble was over his demand that one nail should equal two pins in the transactions of business. It was insisted in some basements and spare rooms and back yards that there ought to be a parity. However, the small boy with access to the nail keg had things his way for a time. He was the only one in his neighborhood who had access to any considerable number of nails, and so he insisted on his demands. He was a trust all by himself for a time. He was the octopus equipped with all its tentacles. He was the juggernaut, cruelly crushing the life out of all competitors. He was a bloated bondholder. He was a corporation, with no soul to save. But his reign was a short one. Other small boys in other neighborhoods found mines of nail kegs in out-of-way places, and they developed them. Now nails and pins are about on an equal footing. They are on a parity. The supply and the demand have equalized things. I wish all the various firms and individuals operating pin (and nail) stores throughout the city the most abundant success. The owners of the pin stores will in time be the owners of all the rest of the stores, and of all the property of all kinds in the land, and they will have all the offices and employments. The fact is, after all, that all of property and all employment and business and social life everywhere is only a grown-up pin store.

I am an Oregonian. Born that way I believe the insurance companies ought to be made to obey the law passed by the last legislature, in spirit and in truth. If this is done, a lot of money that is paid out for clerk hire and superintendence in San Francisco will be kept in Oregon. And some of the big agencies writing blankets insurance in the large cities will send their fat commissions—and let them to Oregon people. Let's stand up for Oregon, first, last and all the time, forever and forever, or until the ice freezes over the Avernus river.

ROBERT JACKSON.

A NEW DEPARTMENT.

Of Oregon, Known as the Ladies of the Grand Army of the Republic.

The Convention was called to order at 1 p. m. Tuesday June 20th, at McMinnville, by the national commander, Mrs. Flora Davy, of Duluth, Minn., who at once proceeded to organize a "department of Oregon." The large Maconie hall was filled with a large and enthusiastic audience of old comrades and their families, and it was a great pleasure to witness the harmony that prevailed during the session of organizing and electing officers of the department. Eight circles were reorganized and every officer elected by acclamation.

Mr. Amy Livingston, of Albany, who organized the first circle in this state, and who has devoted much of her time and means to carry on this work, was unanimously elected department president. Mrs. R. E. Wenz, of Salem, who is and has always been a very earnest worker and a staunch friend of the comrades, was elected to the senior vice's chair. Mrs. Jennie Brown, of Albany, known throughout the state as "Auntie" Brown, a woman who has opened her doors to many a poor and sick comrade, was elected to fill the junior vice's chair. Mrs. E. T. Chapman, wife of the commander of the G. A. R. post of Eugene, was chosen treasurer. Mrs. Dr. Henstis, of Sunnyside, Portland, as chaplain, and Mrs. Quinby, of Albany, secretary; Mrs. Lizzie Woodin, of Portland, national press correspondent; Mrs. Marion Weider, of Salem, was elected chairman of the council of administration; Mrs. S. P. Bendick, of Portland, was elected deputy counselor.

While in session the ladies were honored with a serenade by the band, which they enjoyed very much. After the election of officers the convention adjourned and for two hours

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SAIL FOR MANILA.

San Francisco, June 24.—The transport Sheridan sailed today with troops for Manila. She carried 1842 enlisted men and sixty-four officers. The transport Valencia is expected to sail tomorrow with some additional companies of the Twenty-fourth regiment.

THE GLORY OF ISRAEL.

The glory of Israel found its highest commemoration in the great prophet of Nazareth, whose spirit, teachings and example still lead the throngs of men, still furnish the loftiest inspiration for noble living, for purest loving—Rev. George W. Stone, Unitarian, Kansas City, Mo.

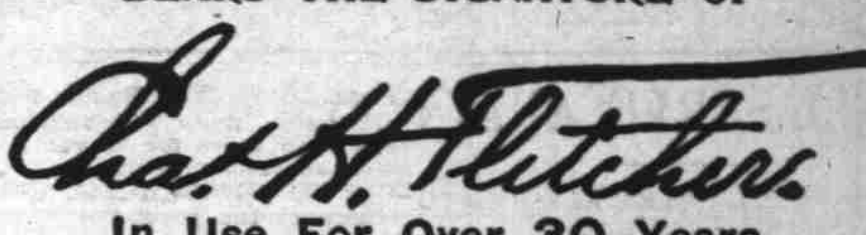
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held a reception, and not only received many of the comrades, but also obliged many in the new order.

On Wednesday, at 10 a. m., they again convened to appoint committees and transact other business. Two charters were ordered—one for McMinnville and one for La Grande. Madama Davy, Wanda Fairbanks, Pierson, Worden and Bendick were delegated to convey greetings from the Ladies of the G. A. R. to the W. R. C.; also Mrs. Wanda and Mrs. Bendick to the comrades of the G. A. R.

Mrs. Wanda delivered the following greetings to the old comrades:

"Comrade and Comrades—Before presenting my greetings, with your permission, I wish to extend a vote of thanks to the committee on arrangements and the Post and Corps of McMinnville for the honored place assigned the Ladies of the G. A. R. in the line of march, this morning. We occupied precisely the same place in the '60s, with this difference: Then we were the girls you left behind you; today we are the wives and mothers. The little toddling boys, some of us were left with in the '60s, and those who God has given us since, escorted us through the streets of your beautiful city. We could not have had a higher honor paid us than to be escorted by the sons of the men who saved this nation. When delegated as a committee to convey greeting to this convention of war-worn and battle-scarred heroes of the '60s, this remnant of that mighty host who stood between that flag and its would-be destroyers, who sustained and supported it on scores of battlefields where the blood of the brave boys of this nation was poured out as freely as water. We felt that a great honor had been conferred upon us, and as we stand in the presence of this remnant of old glory's brave defenders, we feel constrained to exclaim with the psalmist: 'He shall make thy name to be remembered in all generations. Therefore shall the people praise thee forever and ever.' We bring to you the greetings of our newly-organized Department of Oregon of the Ladies of the G. A. R., composed of your wives, mothers, sisters and daughters. From the mothers who loaned you to your country when it needed you more than they; from the wives who, when that flag was threatened with dishonor and destruction, sent you to the rescue with her blessing, baptized with tears, and turned around and faced a bitter world and fought the battle for bread for herself and little ones; from the sisters and daughters who wept and prayed for your safe return. We have no antagonism to any, but are broad enough to embrace all patriotic organizations and extend the right hand of fellowship to everyone that has done one noble deed or expended one dollar for the benefit of the old soldier and his dependent ones. We come from an organization at this time, that has 'wore on earth, good will' to all who were the blue for our guide. Comrades, I extend to you the greetings of a body of women whose hearts beat in sympathy with you, who under God made it possible for us to enjoy one country and one flag—and that without a missing star. And when these conventions shall have ended here below, God grant that every boy who wore the blue may be greeted by that Great Commander-in-chief and be welcomed in the ranks of the greatest and grandest army ever marshaled under any commander—the Grand Army of the Re-Redeemed—is the sincere wish of the wives, mothers, sisters and the daughters of the Ladies of the U. S. A."

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"I did. You told me a little bird was naughty, so I knew it must be him, as there was no other little bird about. So I opened the cage, and the cat's cater him. That's what he's got for telling on me!"—Stray Stories.

Mr. P. Ketcham, of Pike City, Cal., says: "During my brother's late sickness from sciatic rheumatism, Chamberlain's Pain Balm was the only remedy that gave him any relief. Many others have testified to the prompt relief from pain which this liniment affords. For sale by J. H. Lunn, the druggist."

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