ELECTRIC LIGHTING FOR AMATEURS.

It is now possible for any one to procure small incandescent lamps from the Edison Lamp Co. and from most dealers in electrical goods. The prices run as follows: ½, 1, 2, 3, 4, and 6 candle lamps, one dollar each. These little lamps can be operated quite successfully by means of easily constructed batteries. It is, of course, a little troublesome, and the expense of the electric light produced in this way is somewhat greater than other lights, but amateurs can derive a great deal of satisfaction from these experiments in electric lighting.

The battery may be made at home, from materials

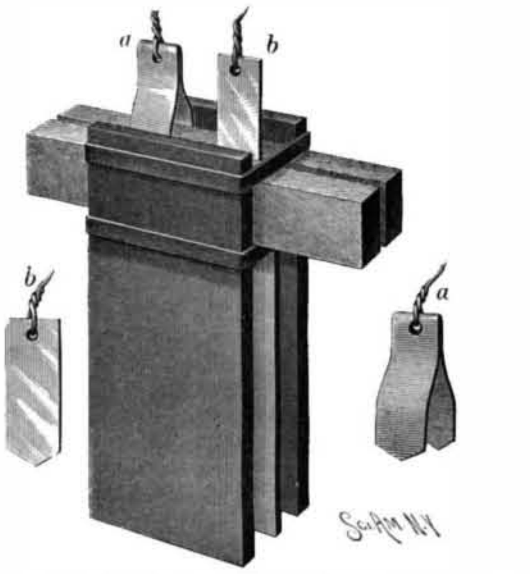

Fig. 1.—ARRANGEMENT OF CARBON AND ZINC PLATES.

that may be purchased from the manufacturers of the lamps or from any dealer in electrical supplies. Each cell of battery consists of two plates of carbon 2 in. wide, 4½ in. long, and ⅛ in. thick, one zinc plate 2 in. wide, 4 in. long, and ⅛ in. thick, two strips of wood ½ in. wide, ¼ in. thick, and 4 in. long, two strong rubber bands, and an ordinary tumbler.

The zinc is amalgamated by dipping it in dilute sulphuric acid (acid one part, water twelve parts), then sprinkling on a few small drops of mercury, rubbing it about with a swab formed of a piece of cotton cloth tied around the end of a stick. Every portion of the surface of the zinc should be covered with mercury. If the amalgamation is perfect, it need not be repeated.

The carbon plates before use should each be heated at one end and saturated with paraffine for a distance of 1¼ in. from the upper end (and no more) to prevent the solution from ascending the plate by capillarity. This is accomplished by heating the end of the plate over a lamp and applying a piece of paraffine or a paraffine candle until it is filled. No free paraffine should be allowed to remain on the surface of the carbon, as it will interfere with making a good electrical connection with the plate.

The zinc plate is placed between the two wooden strips. The carbon plates are placed outside of the strips and held by the two rubber bands, as shown in Fig. 1.

The connection between the carbon plates and the wire leading away from the carbon pole is made by a doubled strip, *a*, of copper, the ends of which are inserted between the wooden strips and the carbon

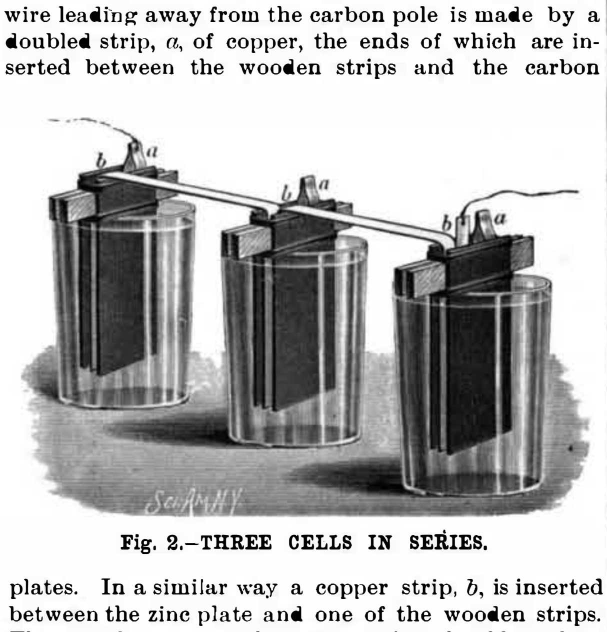

Fig. 2.—THREE CELLS IN SERIES.

plates. In a similar way a copper strip, *b*, is inserted between the zinc plate and one of the wooden strips. The tumbler forming the battery jar should be deep enough to allow the wooden strips to rest upon its rim, so as to support the plates a short distance from the bottom of the tumbler.

The ordinary bichromate of potash solution is used in the battery. It is prepared by making a saturated solution of common bichromate of potash in warm water, then, after cooling, adding very slowly a quantity of common sulphuric acid, equal to about one-fifth of the bulk of the bichromate solution. It is advisable to add to the solution a very small quantity of bisulphate of mercury, say one-eighth ounce to the quart of solution, to maintain the amalgamation of the zinc.

The salts known as the C. & C. battery compound are excellent and very convenient for use in batteries of this class. It is only necessary to dissolve this compound in water to form the exciting solution.

This material is sold in tin cans containing two or three pounds. It absorbs moisture rapidly, so that when it is to be used in small quantities, it should be transferred to a stoppered glass jar.

It is, perhaps, needless to say that great care should be exercised in handling the solution, as it is poisonous and destructive to clothing, carpets, etc. The same remark applies to the battery compound.

One cell of this battery should be allowed for each candle power of the lamp. The zinc of one cell should be connected with the carbon of the next, as shown in Fig. 2. The battery may be arranged as a plunger. Directions for making a battery of this kind were given on page 116, of volume 57, of this journal.

In Fig. 3 is shown a convenient bracket for supporting small electric lamps. It consists of two curved wires attached to a small piece of board by means of screws which also serve as binding screws for attaching the wires. The lamp is suspended from eyes formed in the ends of the wires. This device may be used as a standard, as shown at 1, as a hanger, as shown at 2, or as a bracket, as at 3.

In Fig. 4 is shown a series of three small lamps connected with three cells of battery.

The lamps in this case are connected in parallel or multiple arc, *i. e.*, one binding screw of each lamp is connected with one wire from the battery. The other binding screws of the lamps are all connected with the remaining pole of the battery.

Copper wire, No. 18 or larger, should be used for making the connections. The battery will run continuously with a single charge of the solution for about three hours. Should the solution become warm and give off hydrogen, the zinc should be reamalgamated at the points where it is violently attacked.

How to Prevent the Spontaneous Ignition of Coal in Ships.

In a paper recently read in London before the Institution of Naval Architects, Professor Vivian B. Lewes advocated the ejection of compressed carbonic acid gas, and explained his plan as follows:

If carbonic acid gas is compressed under a pressure of 36 atmospheres at a temperature of 32° Fah., it is condensed to the liquid state, and can be obtained in steel vessels, closed with screw valves. On opening the valve, some of the liquid is ejected into the air, and on coming down to the ordinary atmospheric pressure, is in a moment converted into a large volume of gas. Conversion from the liquid to the gaseous state means the absorption of a large amount of heat, and so great is this, that everything near the stream of new-born gas is cooled down, and some of the escaping liquid is frozen to a solid having a temperature of —108·4° Fah. (−78° C.). I should suggest its use in the following way for the checking of ignition in the coal cargo:

The nozzle attached to the screw valve on the bottle of condensed gas would have a short metal nose piece screwed on to it, the tube in which would be cast in solid, with an alloy of tin, lead, bismuth, and cadmium which could be so made as to melt at exactly 200° Fah. (93° C.). The valve would then be opened, and the steel bottle buried in the coal during the process of loading. The temperature at which the fusible metal plug would melt is well above the temperature which could be reached by any legitimate cause, and would mean that active heating was going on in the coal. Under these conditions, the pressure in the steel cylinder would have reached something like 1,700 pounds, and the moment the plug melted, the whole contents of the bottle would be blown out of it into the surrounding coal, producing a large zone of intense cold, and cooling the whole of the surrounding mass to a comparatively low temperature. The action, moreover, would not stop here, as the cold, heavy gas would remain for some time in contact with the coal—diffusion taking place but slowly through the small exit pipe.

When coal has absorbed as much oxygen as it can, it still retains the power of taking in a considerable volume of carbonic acid gas, and when coal has heated and then been rapidly quenched, the amount of gas so absorbed is very large indeed, and the inert gas so taken up remains in the pores of the coal, and prevents any further tendency to heating. Indeed, a coal which has once heated, if only to a slight degree, and has then cooled down, is perfectly harmless, and will not heat a second time. It is not by any means necessary to replace the whole of the air in the interstices of the coal with the gas, as a long series of experiments show that 60 per cent of carbonic acid gas prevents the ignition of the most pyrophoric substances. A hundred cubic feet of gas can be condensed in the liquid state in a steel cylinder 1 foot long and 3 inches in diameter, and it has been shown that a ton of coal contains air spaces equal to about 12 cubic feet. One of these cylinders would therefore have to be put in for every 8 tons of coal, and these would be distributed evenly through the cargo, and near the alarm thermometers, which would be set to ring a degree or two below the point at which the fusible plug would melt. The bell ringing in the captain's room would warn him heating was taking place, and the bell would continue to ring until the cylinder had discharged its contents and had cooled down to a safe degree, so that the whole arrangement would be purely automatic, and yet the officers would know if everything was safe. If the precautions advocated were taken, no danger could arise until the arrival of the ship at her destination, and the commonest precautions would then suffice.

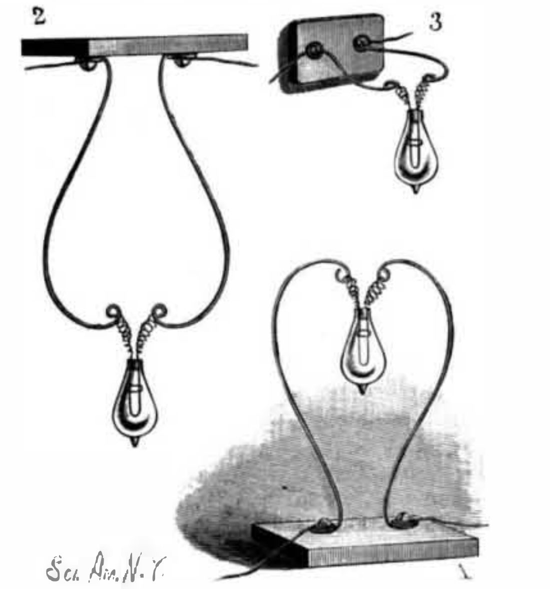

Fig. 3.—LAMP SUPPORT.

In conclusion, Professor Lewes remarked that the question of preventing the heating and ignition of stores of coal on land and ready for use in bunkers could not be met so well by the use of the liquid gas, and in these cases it would be found beneficial to dress the coals with a little tar or tar oil, which would close the pores, and to a great extent prevent oxidation. He believed this was advocated by Lachman about 1870. Crude petroleum in small quantities for this purpose would also be found valuable, for it had no tendency to oxidize itself, and lowered the tendency in other bodies, besides coating them and so preventing access of oxygen.

The Plate Glass Industry.

The manufacture of plate glass is evidently one of the most prosperous industries in the United States to-day. But whether it will continue to be such, in view of the large increase of capacity projected, is a question which time alone can determine. There are already eight great works in operation, viz.: Crystal City, Duquesne, Creighton, Tarentum, Ford City, New Albany, Kokomo, and Butler, capable of making from 9,000,000 to 10,000,000 square feet of glass per annum, according to recent estimates, or almost as much as the present requirements of the country call for. What then is to become of the heavy additional production promised is not known, without lower prices for the article can greatly augment consumption. But the work on new plants and additions to old ones is going on just the same, nevertheless. At Charleroi, the newest industrial city of Pennsylvania, a huge plate glass establishment is being erected, and

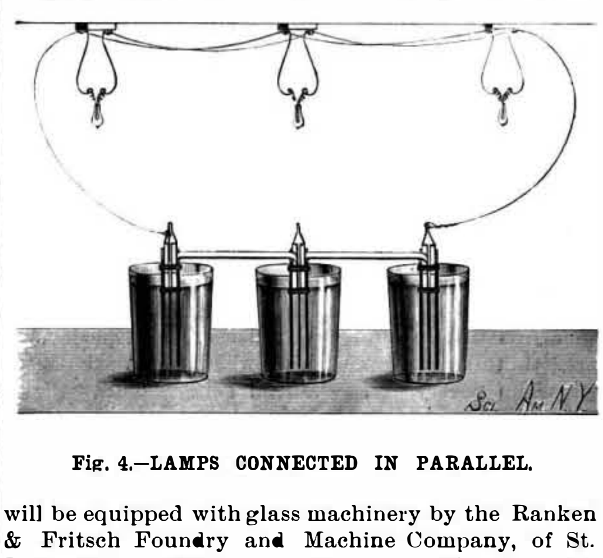

Fig. 4.—LAMPS CONNECTED IN PARALLEL.

will be equipped with glass machinery by the Ranken & Fritsch Foundry and Machine Company, of St. Louis, at a contract cost of $308,000. The Diamond Plate Glass Company, of Kokomo, Ind., through a branch $2,000,000 incorporation, is putting up a works at Elwood, Ind., to make 20,000 feet of finished glass a day and give employment to about 2,500 men. The Pittsburg Plate Glass Company purpose doubling their present plant at Ford City, at an outlay of $1,750,000, so as to surpass all competitors in the matter of output, at home or abroad. Other companies still are enlarging, and entirely new enterprises of the kind are being either actually organized or talked of in various parts of the country.—*Age of Steel.*

The Care of House Plumbing.

It is not all of life to live, nor all of plumbing to plumb. Simply to live is to fail in all the purposes of life. So the simple fact that a residence has been plumbed does not eternally secure the sanitary drainage of a house. This work, however perfect when placed, may in time get out of order and need repair. The settling of a building may break a joint or otherwise cause defects in the drainage which no foresight of the best plumber in the country could prevent. Decay is written on the face of everything, and plumbing work forms no exception and should receive the best of care, for its perfection is of the highest importance to health. In regard to its care a writer in the *Sanitary Era* points out the importance of efficient care of plumbing and suggests two annual tests of the safety of the drainage. The water test, as suggested, would probably be disastrous to carpets, etc., in some instances and could be replaced by other tests. The *Sanitary News* agrees with the *Sanitary Era* on the importance of inspection, but suggests that it would be to the interest of the householder to have a qualified plumber to do the work. Nooks and corners, fixtures and exposed pipes can be kept clean by any one, but a proper inspection of the plumbing work can best be made by a plumber. The writer referred to says:

"The disease-breeding dangers of house drainage require of the occupant accommodated with water carriage of waste a well instructed and perpetual vigilance. The best plumbing is liable to deterioration from a variety of causes, like everything else, and the worst needs no comment, except that there is enough of it to make expert examination of the system from top to bottom before buying, accepting, or hiring a house, the plainest dictate of prudence. Not only at the beginning, but at least once a year ever after, all the pipes and joints should be tested for leaks by plugging up the mouth of the house sewer or drain, and filling the whole system with water by the ventilating pipe at the roof. Leaks, if any exist, will then manifest themselves by the gradual lowering of the water at the top of the filled ventilator pipe, and will locate themselves by wetting the premises—which should be at all points open to inspection for this purpose. If in that case no leak should appear within the house, and yet the test water should lower, the defect is in the drain, which will rapidly create a pestilent condition in the soil near the house if not remedied. Obstructions, however, may possibly frustrate the water test, or the peppermint test, and this should be guarded against by particular tests from floor to floor. If the pipes are free, the pouring of a little oil of peppermint into the ventilating pipe gives a very delicate test of leaks by its strong escaping odor. But as this may not be definite enough as to the locality, the house cat may be employed as a detective, by using instead the oil of valerian or 'catnip,' which the creature's nose will locate infallibly if the least aroma of her favorite perfume transpires through the joints.

"Constant attention to the nooks and corners about and within the pipes and fixtures is even more necessary to cleanliness and health than in all other parts of the house, and nothing of that sort should be boxed up out of sight. The traps should be occasionally examined, especially after continued disuse, to see that they are full of water at all times, and free from other deposits. The safes, or drip pans, under basins and water closets, as well as the interior of the latter, should be regularly cleaned, and the waste or soil pipes should be dosed with strong lye to clear out the tenacious slime that adheres to their sides.

"But in the proper sanitary care of the house drainage there is great help to be had from the most improved fixtures. This is a subject well worth thorough study by every householder."

The Inventor of To-day.

A writer in the Boston *Herald* says: If there is any man to whom the term "self-made" will most truly apply, it is the inventor. He must possess three general characteristics peculiar to all men who achieve success in life, but in more full development than most others, to wit, ingenuity, enthusiasm, and perseverance. Like the true poet, his soul is in his work; but his is the poetry of substantial achievement, which gives wealth, as well as happiness, to mankind. If it be desired to harness the forces of nature for human benefit, the inventor devises the harness in the shape of machinery to operate with. Every comfort which we enjoy in civilization bears the sign manual of the inventor's skill. Our clothing, furniture, the houses we live in, our means of travel, the carriages and ships we own and employ, the books and papers we use, even the luxuries we can command, are all largely due —at least their best utility and excellence are—to the genius of the inventor.

The first success of the inventor, no matter how insignificant it may be, is usually the first step in a new life of the most absorbing interest to himself, and satisfaction also; but it is likewise the first step in the treadmill of unceasing effort and thought—a treadmill that never stops for him while life remains. Go where he will, he cannot escape its operation. Every piece of machinery he sees suggests something to his busy brain, and, in fact, everything that he observes suggests an improving device to him. But it is rarely or never plain sailing with him in anything he undertakes. One of the things that troubles him a great deal is the improvements he is all the time making of his own work; and often, when he has secured a patent on some machine, his mind has so far advanced in improved devices for it that what he has secured is practically valueless to him.

One of the main things for an inventor to learn in the invention of machinery is to have in every machine as few parts as possible, to make them direct-acting, and have the machine or thing, as a whole, easily operated. Mr. Edison once said that very many of the most meritorious inventions that were ever made were not successful, because it required some skill and brainwork to operate them. "To make a success of a thing," he added, "you must have it so simple and easy of operation that a mule can operate it. Then you have a thing that will come into general use, if it is presented to the world in a business way."

The newer fields of invention are most promising for the young inventor. One of these is electricity. The best inventions in this field have mostly been made in the last fifteen years—largely, indeed, inside of the past decade. Here the field is opening out and widening all the time, as new applications of the electric current or electric energy are being constantly discovered. Already the inventors in this field can be counted by the hundred, and there are, perhaps, more successful ones among them—that is, the ratio is greater than in any other field of invention. Just for a moment look at the prospect here presented. In the electric current we have an element of power that is more easily controlled and handled, more easily diffused over large areas, more adaptable to a greater variety of purposes, than any other of the forces of nature within our control. It will heat our houses, do our cooking, furnish us with light, and convey power anywhere that we may desire it to, and in any proportion we may call for. This covers a wide range of application, but it by no means exhausts the uses and purposes to which electricity can be applied, and this field, it will be seen, is therefore a most promising one to the young inventor.

Mat Manufacture in Cochin.

The following account of the history and manufacture of Wadakaucherry mats has recently been given in a report on the Agricultural and Industrial Exhibition held at Mysore in October of last year.

The mats are made at Wadakaucherry, a taluk of Cochin. They are known at the place by the simple name of grass mats, and are recognized elsewhere by the name of Palghat and Kavalapasa mats, other places of manufacture. The industry was introduced into Cochin from Kavalapasa about forty years ago. At first there was but one family engaged in the trade; it has now increased to three, consisting in all of twenty souls. Both males and females are employed in the work. The men were originally brought for making mats from the Sircar, and were provided with free quarters. Such is the short history of the introduction of the industry into Cochin.

These mats are made, like the Palghat mats, of a kind of sedge (*Cyperus Pangorei*) grown by the side of swamps and rivers. The sedges grow to a height of six feet by one and a half inches in circumference, and are of a triangular shape. They are collected in the rainy season. The culms or stems are split, and the inside pith removed, and are then dried. Each stem may be split into from four to eight, or even twelve, according to the delicacy of the texture intended. The strips are then well seasoned and sewn into mats. Women are mostly employed in the collection and splitting of the stems, while the actual weaving is done by men. The loom used for the purpose is of simple construction, consisting of two bamboo pieces at either end, attached to pegs driven in the ground. The warp consists of twine made of country hemp, and is produced by the weavers themselves. In special cases cotton thread is also used instead of twine. The process of weaving is done by the strips of sedge being passed to and fro crosswise, by means of a stick with a hole at one end of it to which the sedge is attached. The warps are passed through a movable piece of wood with as many holes as there may be warps, and are tied up to the bamboo pieces at either end. According to the number and nearness of the warps, the greater is the delicacy and strength of the texture. The woof is made compact by means of the piece of wood above described.

The distinguishing peculiarity of the Wadakaucherry mats is their brilliant color. Only four varieties of it can, however, be had, namely, the white, black, red, and yellow; of these the last is the readiest to fade, and is obtained from a peculiar solution of turmeric and cassia leaves. White is the natural color of the strips when properly prepared, red is obtained by boiling the strips in water containing sappan wood and cassia leaves, black is but a conversion of red by a peculiar process of boiling the red strips in a solution of gall nuts and green vitriol, and by subsequent soaking in a preparation of black clay. The difficult and dextrous portion of the work is the splitting and dyeing of the strips; the same have to be colored with different colors, and this has to be done very carefully with reference to the size of ornamental work intended to be produced. When one color is being worked at, the rest of the strip which has to be colored differently will be closely covered with the outer covering of the plantain tree. The process of drying and dyeing the strips may take a fortnight.

Natives use the mats as seats, and also for mattresses in the hot weather. A sort of social distinction is associated in the offer of these mats as seats, and among the vulgar, disregard of it on ceremonial occasions tends to foment disputes. These mats are also used for flooring, and are then woven to the size of large halls and rooms. The mats vary in price from 1 to 10 annas, while the superior kinds fetch from 15 to 25 rupees, according to quality.

Experiments have been made with other colors besides those just mentioned. but hitherto without success. If the industry were carried on by organized capitalists, these experiments might perhaps be successfully repeated, and many other improvements effected, such as facilitating the splitting of the sedge and keeping it compact by means of mechanical aid, and also relieving the weavers from the stooping they have always to assume when engaged in the work.

The mats of Wadakaucherry, compared with those of Tinnevelly, are generally superior in color and ornamental work, but are less pliable, though the strips are sometimes more delicate.

Endurance of the Odor of Musk.

Many marvelous accounts are related in works on pharmacy and organic chemistry, with regard to the extraordinary duration of the scent of musk, and the extremely small loss of substance which a grain or two of this substance, exposed to the air, has been found to undergo in the course of several months, or even years. But an instance of this endurance of the musk odor has come under our personal observation in the following manner. In 1850, at Brussels, three small volumes were presented to us. They were bound in red cloth, and inclosed in a green cardboard case. In this case a very minute quantity of musk mixture, from a sachet, was placed in order to scent the volumes. Since the year 1850, these three little red volumes, in their green cardboard case, have been constantly exposed to the air, on the shelves of a library, as well as to daylight. They have been in constant, almost daily use (for they are standard works of reference), and they have traveled with the writer to Ostend, to Paris, to Frankfort, to Scotland, to the South of England, to various seaside resorts, to London, and many other places; yet, at the present moment, after a period of forty years, and being exposed to many kinds of climates, these little books retain their odor of musk, which is as powerful, especially on warm days, as it was in 1850 when the volumes were received.

A new invention by Messrs. E. Schnauffer and H. Hupfel, of Frankfort, for the manufacture of a substitute for musk, is an imitation of the old method of making artificial musk by treating oil of amber with nitric acid; only the authors above named use other hydrocarbons, namely, benzene, toluene, or xylene, which also belong to the aromatic series. But these are first converted into isopropyl, isobutyl, or isoamyl derivatives, and then nitrated. The products of this reaction are thrown into water, whereupon a reddish brown oil separates; this is washed several times with alkaline water to withdraw all residue of nitric acid. In the concentrated condition this oil has a sweet odor, and when diluted in alcohol it gives off a penetrating, enduring odor of musk. Here is an example of the operation in question with xylene. Metaxylene, as it is called, is heated with isobenzyl, alcohol, and chloride of zinc, under pressure, and the resulting compound, known as dimethylisopropylbenzene, subsequently treated with nitric acid yields the oil $C_{12}H_{17}NO_2$, which is the musk odor in question. For perfumery purposes it would be used in the form of a dilute alcoholic solution.—*Monthly Magazine.*

George W. Carter, who discovered natural gas in Indiana, and to whose pluck and energy its success in that State is due, recently died at Eaton, Ind., from paralysis. Several years ago, at Muncie, he sunk a well several hundred feet deep, on the banks of the Mississinewa River, after coal, which was supposed to be there. On striking the Trenton rock, the gas odor frightened away the diggers, who did not know what it was that they had found. The well was filled up and the coal search abandoned, no one knowing the usefulness of the new discovery. When gas was found at Findlay, Mr. Carter was one of the passengers on an excursion train run over to see the wonder. He found the great new fuel to be nothing more than what he had abandoned. He went home and sunk a well where he had filled the one up before, and got the first gusher in Indiana. There is now talk of erecting him a monument.