POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

The Association held its regular weekly meeting at its room at the Cooper Institute, on Thursday evening, April, 12, 1866, the President, Prof. S. D. Tillman, in the chair.

THE WAY TO MAKE A FILTER.

Mr. Thompson, of Cayuga, N. Y., described his method of making a filter. He divides a deep wooden tub by a tight vertical partition through the middle, perforating the partition at the bottom with numerous small holes. The tub is nearly filled on both sides of the partition with granulated charcoal made from sugar maple, and screened through a mesh of one-sixteenth of an inch, the fine dust being separated by bolting. The foul water enters the tub on one side at the top, passes downward and through the small holes in the partition, and rises upward on the other side, leaving its impurities, both solid and gaseous, in the charcoal.

Mr. Thompson stated that one practical difficulty that he had encountered in filters was the adhesion of the water from cohesive attraction to the walls of the filter, down which it flows in narrow channels without passing through the purifying material. To remedy this he now surrounds the filter on the inside with a series of narrow ledges, sloping downward and inward, which conduct all the water into the body of the charcoal.

The best wood for making charcoal for filters is boxwood, but it is impossible to obtain enough boxwood for the purpose. The wood that comes next to this in excellence is sugar maple, and this, consequently, is employed. It must be burned twice, once under turf, and afterward in a tight retort or cylinder, the combustion being continued till all the gaseous products are expelled.

Charcoal is far better to catch the solid impurities in water than sand, or even than broken quartz. If carefully burned and granulated, so as to preserve the fibrous structure, each one of the little pores may be seen under a microscope surrounded by a serrated edge, presenting the best surface possible for arresting any matter floating in the water. As in addition to this power of mechanically separating the solid impurities, charcoal possesses in the highest degree, the power of absorbing the gases held in solution by water, it is, unquestionably, the best of all materials for filters.

Mr. Thompson said that his filters would occasionally become fouled, and the water for a few days would be unfit to use; the filter would become clear again and the water would be as sweet as ever. He asked for an explanation of this action.

[The explanation is doubtless this: The solid organic matter collects in the filter until it has accumulated in sufficient quantities to induce decomposition, when it gives off carburreted and sulphurreted hydrogen, and the other offensive gases which are the usual products of animal and vegetable decay.—EDS. SCI. AM.]

Professor Everett remarked in relation to the method of preparing the charcoal, that if Mr. Thompson would examine the mode followed by powder makers, he would find it more simple than the one that he had described.

Dr. Parmelee observed that the best filtering is soft brick.

PEAT.

The President announced the regular subject of the evening, which was peat. A long discussion followed, but we report for our columns only the statement of—

Mr. Hirsh. At a previous meeting the assertion had been made that in refining sugar, peat charcoal would decolorize the sirup as well as bone charcoal, and Mr. Hirsh, being engaged as a chemist in a sugar refinery, decided to try the experiment. Into each of seven glass beakers, he put 15 grammes of peat charcoal, and into another beaker of the same form and size 15 grammes of bone charcoal. A glass tube was inserted into each beaker, with its lower end to the bottom of the beaker, and through these the coal was saturated with dark-colored sirup. After standing three hours—the usual time in large operations—the sirup was forced out at the top of the beakers by fresh charges poured through the tubes. That which had passed through the bone charcoal was perfectly white, while that which had passed through the peat was only partially discolored.

Mr. Hyde remarked that the peat used in this experiment had been burned four years, whereas it should be freshly burned.

ILLIG AND NEUBERGER'S FRUIT CAN.

The old way of preserving fruit for winter use was, as all persons know, to use an inordinate quantity of sugar and boil the fruit in the same till it lost all flavor. The result was an unwholesome preparation, totally devoid of the natural flavor of the fruit. A vast improvement on this is the method now in vogue of scalding the fruit and sealing it up hot in its own juice, in cans or jars made for the purpose.

These engravings represent an improved can for the purpose, which is admirably adapted for its object. The can has a tin cover, A, fitting over a projecting rim on the body of it; said rim having a rubber joint or gasket, B, let into a recess so that it cannot slip off. When the fruit is in and properly scalded, the cap is pushed down and immediately seals it up from contact with the air.

It sometimes happens that the steam from the scalding fruit lifts the cover again, so that air is admitted and the contents spoiled unless some one places a weight on top to keep it down; where there are many hundred cans in preparation at once this is a troublesome piece of work, and therefore the inventors provide two small buttons, C, which hold the cover firmly in place and prevent the evil referred to. This can has been in use one season, and is highly approved. The inventors wish to sell State, county, or shop rights to manufacture. For further information address Illig & Neuberger, 137 Clinton street, Buffalo, N. Y., by whom it was patented on April 11, 1865.

PROF. DOREMUS'S LECTURES.

At eight o'clock in the evening of Tuesday, April 17th, the Academy of Music, in Brooklyn, was filled from floor to dome with the best citizens of the place to listen to the first lecture of Professor Doremus's course, which he entitles "Views of Life through the Medium of Natural Science."

These lectures are an enterprise of the Mercantile Library Association, of Brooklyn, which has appropriated $3,500 for the experiments; $2 is charged for admission to each lecture, or $5 for the course of three. The stage was covered with tables loaded with elegant apparatus, all of the largest dimensions, and the scene painter had been employed to produce geological illustrations on a gigantic scale. As the lecturer spoke constantly from eight till half-past ten, it is impossible for us to give a verbatim report of his remarks; we select a few of the more interesting portions:—

THE THREE STATES OF MATTER.

After a brief and eloquent introduction, the speaker said that he should consider matter first in its three forms—solid, liquid, and gaseous, and the relations of these three forms to heat. He would exhibit experiments to show that when matter changes from the gaseous to the liquid state, or from the liquid to the solid, heat is generated; also other experiments to show that when matter changes in the reverse way, from the solid to the liquid, or from the liquid to the gaseous, heat is absorbed, or cold is produced.

THE COLOR OF GASES.

First, he would call the attention of the audience to the properties of gases. They are all transparent, and most of them are white and invisible, though a few are delicately colored. "This vase is filled with bromine gas, which is red, as you see. This contains chlorine, which derives its name from its green color. If I turn this vase over, which contains hydrochloric acid, those near the stage will perceive that some gases are possessed of odor as well as color."

THE WEIGHT OF GASES.

On the stage was a pillar some ten feet in hight, supporting at its top a balance beam about eight feet in length, from the ends of which were suspended scales of the same proportions. On one scale was an empty barrel, exactly poised by weight in the opposite scale. Two assistants took up a barrel of carbonic acid gas, and poured it into the barrel upon the scale. Ot course the operation presented exactly the appearance of pouring nothing from an empty barrel; but the carbonic acid, being about once and a half heavier than atmospheric air, was poured as water would have been, and its weight was shown by the immediate tipping of the beam.

The weight of carbonic acid gas was exhibited in another manner not less impressive. A large tank full of the gas had been fixed among the scenes, at an elevation of some fifteen feet, and from the bottom of the tank at the front side a trough, ten or twelve feet in length, inclined downward at an angle of 45°. Two rows of short candles were burning in the bottom of the trough, and just beneath its lower end was hung a light overshot wheel, four feet in diameter, made of paper and laths. At a signal, an assistant, by pulling a string, opened a door in the side of the tank at the upper end of the trough, when the invisible gas flowed downward through the trough, extinguishing the candles in succession, and when it poured from the lower end upon one side of the overshot wheel, the wheel began slowly to revolve.

CARBONIC ACID.

"This vase is filled with carbonic acid. You see that it is as transparent and invisible as the atmosphere. I will dwell for a moment on its properties in consideration of the great part which it performs in the life of our globe. It is composed of carbon and oxygen. When it enters the leaves of vegetables it is decomposed by the force of the sunbeam; the oxygen returns to the atmosphere and the carbon enters into the composition of the grains and the roots that we eat. This gas is the supporter, therefore, of vegetable life—the original source from which we derive the food that sustains our own existence. The oxygen exhaled by the vegetable enters our bodies through the skin, as well as through the lungs, and coming again in contact with the carbon of our food enters into combination with it, and this gas is again produced. By this combination the heat of our bodies is maintained. Like Shadrach, Meshach, and Abed-nego, we are constantly burned without perceptible change. From this gas, then, we are originally formed, and to it principally we return. It is the alpha and omega—the beginning and the end of life."

THE PECULIAR COLDNESS OF SHERRY COBLERS.

Among the experiments intended to illustrate the absorption of heat when bodies are changed from the solid to the liquid state, was one which was thus described, as it proceeded:—

"It I put some water into this tumbler, add a little ice which is at the temperature of 32°, a little sherry wine, and a little sugar, and agitate the mixture till the sugar is dissolved; on introducing the thermometer into the liquid, I find the temperature is several degrees below that of the ice at the beginning. Those who have observed the peculiar coldness of a sherry cobler, will understand that it is due to the absorption of heat by the sugar in passing from the solid to the fluid state."

BURNING OF EXPLOSIVES IN VACUO.

After several other experiments similar to those o which we gave an account last year, the lecturer said that he would exhibit one which, though not very impressive, was of very peculiar interest—this was the burning of explosives when removed from the pressure of the atmosphere. Though gunpowder contained sufficient oxygen to effect its combustion, yet when heated in a vacuum, it boiled away without any explosion; fulminating mercury and other fulminates behave in the same manner. Gun-cotton, if heated to incandescence in a vacuum, is slowly dissipated without combustion. A strip of gun-cotton was then attached to a loop of platinum wire, and placed in a bell glass. The wire was connected with the poles of a small galvanic battery, which soon brought it to a red heat. The lower end of the gun-cotton was charred, and when the current was broken it ceased to glow. The bell glass was then filled with air, and the cotton was taken out; on again closing the circuit the platinum wire was quickly reheated, when the gun-cotton vanished with a flash.

SCALE OF EXPERIMENTS.

Besides the novel experiments exhibited in these lectures, the ordinary class experiments are conducted on a scale which produces the effect of novelty. For instance, in burning potassium on water, a tank was used which extended entirely across the theatre in front of the stage, covering the whole area of the space usually occupied by the orchestra, and the middle of this tank contained several hundred pounds of ice in massive blocks; upon this water and ice half a pound or more of potassium pellets were scattered, producing most brilliant corruscations of violet and yellow sparks and flames, and filling the whole theater with a cloud of potash. Several gallons of liquid carbonic acid was condensed, and the bar of mercury frozen by it was a yard in length and two inches in width. To exhibit the combustion of steel in the blow pipe flame, a whole saw and half of a long sword were burned, the sparks pouring forth in a shower fifteen feet in length.

Professor Doremus has a remarkably clear, loud voice, and every word of his long lecture was heard in all parts of the house. The experiments succeeded each other so rapidly, that the audience was entertained and delighted to the close.

MATCH MAKING.

The query, what becomes of all the pins? might be met with another—what becomes of all the matches? We have often thought that as conveniences multiply and become common, people lose a sense of their value, so that, only those respectable persons, "the oldest inhabitants," appreciate them. In the "flint and steel" days, happily gone by, it was only by dint of much tinder, wind, and patience, that a light could be obtained, and unhappy sufferers in the pangs of colic or others yet more sorely oppressed, waited anxiously for the lucky spark that should fall on the tinder; brightening at last into a ruddy glow to chase away the darkness and the pain together.

Who attaches any consequence to a match? Certainly not he who seizes one at random from the safe on the wall, and curses it if it fails. Not he who finds a bundle of them ready at hand in all places, high and low. But despite the low estimation in which they are held, the manufacture of them is one of the most important of the minor branches of industry, in all countries.

Willis says in one of his poems-

"I am not old, my locks are not yet gray,"

but we can call to mind not long ago when matches were a curiosity and were carefully used, not squandered, as they now are. They were sold at a shilling per box, and in still earlier days at much higher prices. As to the quantity now made, it is something enormous. Even in one factory in this State they use in one year no less than 720,000 feet of pine of the best quality for matches, and 400,000 feet of bass wood for cases. Of sulphur—ill smelling compound 400 barrels are required, and of phosphorus 9,000 pounds. To make the boxes 500 pounds of paper are used daily, and for the larger boxes 8,000 pounds of pasteboard weekly. They also use 66 pounds of flour for paste every day, and the proprietors pay $1,440 for penny stamps daily.

A large factory in England has some peculiar features which are interesting. The wood to be made into matches is cut up into lengths which are afterward divided into the size of matches. These splints, as they call them, are then heated, or slightly charred on the ends, which is said to make them dip better; the paraffine and brimstone, both of which are used in the manufacture, being absorbed better by the hot wood than if cold.

The splints are next carried to one of the framing rooms. There are two of these, each seventy feet long by thirty-five feet wide, proportionate hight, and well ventilated. In these rooms the utmost activity prevails, upwards of three hundred children being employed in placing the prepared matches in frames previous to the combustible mixture being attached to the ends. In each room there are twenty-four tables, each having a stand for twelve persons.

The table is similar to a large school desk, but more upright. An iron frame is placed in a standing position, and from a quantity of matches lying on the flat part of it the framer takes and places a run at the bottom upon a small piece of board with notches in it to receive fifty, at equal distances apart, then piles one board upon another, each run having the fifty notches placed in the grooves, and in a few minutes the task is completed. The whole is then screwed tightly together, forming a compact mass. Each child takes her full frame, and according to her number—each person being known in the building by one—a mark is made on a slate by a person at the end of the room, when at the end of the day the number of frames each has filled is counted and paid for her portion at the end of the week. It is curious to the visitor to hear the constant reports of lucifers being trodden upon, but the floor being either of stone or iron, all danger of fire is done away with.

The room in which the composition is mixed and prepared is called the kitchen, and a very important place it is. Great care is required and the process is performed by two steady and skillful men. The ingredients are given to one of the men, who first mixes it in a pan, dry, similar to a cook making paste and when worked with the hands, sufficiently, is laid upon a stone or iron slab. Water is then added to it and a stiff paste made. It is then placed in pans and a certain quantity of glue added, to make it adhesive to the matches. Steam is used for all the heating processes.

The next process is the dipping, or covering the ends of the splints with the explosive material. A panful of the mixture is taken from the kitchen, and put into a receptacle of hot water, which is kept at a certain heat during the time required. The dipper takes the frames which are brought by the girls from the framing room, and (after the mixture is placed upon the iron slab, and regulated by a gage to about the thickness of one eighth of an inch) dips them into the thin paste, the whole of which is charged with the explosive ingredients.

After the matches have been dipped they are taken by the boys to the drying-rooms. These are three in number, one to each dipper, and they are built with every care for the prevention of accident. The floor is thickly spread with sawdust, which causes the loose matches to sink under the feet and thereby escape friction. The rooms are of arched brick, having double iron doors, and should a fire occur, these doors could be closed, and the ventilators or air-traps at top let down by the dipper, and the rooms hermetically sealed; the fire is then smothered. For every frame taken into the dipping room, one of a two days' drying is taken out to the packers; and from there being 50 splints in a row, boxes containing 100 or 200 are easily filled, very little calculation being required. Nevertheless, it is surprising to see how dextrously the filling is done, as is also the framing; many of the children not being more than nine or ten years of age, and their little fingers acting like clock-work.

The box making is the last round in the ladder, and forms a very good concluding part of the process of making a simple box of lucifers. The wood of the boxes is made of the best spruce-fir, pieces of a sufficient length having been placed upon a movable plane, which travels backwards and forwards upon a railroad. When the plane is cutting the wood it is pulled by steam power along the under surface of the block, it being securely held in its place at either end by screws and blocks. The slices are cut with amazing rapidity, and it requires two of these powerful machines to keep supplied the boys who prepare them for the boxes.

The boys take the slips or slices, and in quick succession place them upon a block which is gaged with thin pieces of metal. They then bring down upon the slice of wood, with some degree of strength, a block indented with a corresponding gage, which marks the grain of the piece of wood, so as to double it up into the shape of the box, and cut it off at the same time. One boy can cut or prepare twenty gross an hour.

Doubtless in our factories there are some improvements on these plans. If so we should be pleased to receive an account of them.

All Things in Motion.

In imagining the ultimate composition of a solid body, we have to reconcile two apparently contradictory conditions. It is an assemblage of atoms which do not touch each other—for we are obliged to admit intermolecular spaces—and yet those atoms are held together in clusters by so strong a force of cohesion as to give to the whole the qualities of a solid. This would be the case even with a solid undergoing no change of size or internal constitution. But solids do change, under pressure, impact, heat, and cold. Their constituent atoms are, consequently, not at rest. Mr. Grove tells us: "Of absolute rest nature gives us no evidence. All matter as far as we can ascertain, is ever in movement, not merely in masses, as with the planetary spheres, but also molecularly, or throughout its most intimate structure. Thus, every alternation of temperature produces a molecular change throughout the whole substance heated or cooled. Slow chemical or electrical actions, actions of light or invisible radiant forces, are always at play; so that, as a fact, we cannot predicate of any portion of matter, that it is absolutely at rest."

The atoms, therefore, of which solid bodies consist are supposed to vibrate, to oscillate, or better, to revolve, like the planets, in more or less eccentric orbits. Suppose a solid body to be represented by a swarm of gnats dancing in the sunshine. Each gnat or atom dances up and down at a certain distance from each other gnat, within a given limited space. The path of the dance is not a mere straight line, but a vertical oval—a true orbit. Suppose then that in consequence of greater sun heat, the gnats become more active, and extend each its respective sweep of flight. The swarm, or solid body as a whole expands. If, from a chill or the shadow of a cloud, the insect's individual range is less extensive, the crowd of gnats is necessarily denser, and the swarm, in its integrity, contracts.

Tyndall takes for his illustration a bullet revolving at the end of a spiral spring. He had spoken of the vibration of the molecules of a solid as causing its expansion, but he remarks that, by some the molecules have been thought to revolve round each other; the communication of heat, by augmenting their centrifugal force was supposed to push them more widely asunder. So he twirls the weight at the end of the spring, in the open air. It tends to fly away; the spring stretches to a certain extent, and as the speed of revolution is augmented, the spring stretches still more, the distance between the hand and the weight being thus increased. The spring rudely figures the force of cohesion, while the ball represents an atom under the influence of heat.

The intellect, he truly says, knows no difference between great and small. It is just as easy, as an intellectual act, to picture a vibrating or revolving atom as to picture a vibrating or revolving cannon ball. These motions, however, are executed within limits too minute, and the moving particles are too small, to be visible. Here the imagination must help us. In the case of solid bodies, you must conceive a power of vibration, within certain limits, to be possessed by the molecules. You must suppose them oscillating to and fro; the greater amount of heat we impart to the body, the more rapid will be the molecular vibration, and the wider the amplitude of atomic oscillation.—*All The Year Round.*

In the reign of Darius gold was thirteen times more valuable, weight for weight, than silver. In the time of Plato it was twelve times as valuable. In that of Julius Cesar gold was only nine times more valuable, owing perhaps to the enormous quantity of gold seized by him in his wars.