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 clockwork.

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.