seen in Fig. 1. This prevents all play and consequent wear, rendering the motion of the vehicle, so far as the thills are concerned, quite noiseless. It will be noticed in Fig. 2 that when the thill is in place one of the edges of the transverse piece on the end is under the projecting lip over the rubber block, and the thill is thus prevented from being casually or accidentally lifted from its place. With this device the thills can be removed from the carriage and a pole substituted in a moment to adapt the carriage for a span instead of one horse. By the readiness with which the removal of shafts or pole can be effected, the carriage takes up less room in a stable and they may be kept out of danger of breaking by being stepped upon or driven over.

A patent was issued through the Scientific American Patent Agency, for this improvement, May 21, 1867, to Thompson Hersee, Jr., 307 Main street, Buffalo, N. Y., who may be addressed for further particulars.

Science Familiarly Illustrated.

Insects.

All insects have six legs, unless they have met with accidents. They do not breathe through their mouths, but by means of a great number of little pipes which run through them lengthwise, having openings here and there on the sides of the body where the fresh air is drawn in. These little openings are very curiously contrived—in some cases protected by tiny trap-doors opening on hinges, in others having a strong grating over them of very coarse hairs. Hence, an insect when cut in two, as he does not use his mouth for breathing, and as his brain is not confined to his head but runs all through his body, will live for many hours in this mutilated state. In fact some insects never eat a mouthful after they are full grown.

Insects have from two to five eyes. Two large eyes called compound eyes, because they are made up of many little eyes united, like a bundle of six sided spy-glasses tied together, large at one end and very small at the other, and looking under the microscope, like the meshes of a very fine net. Then there are sometimes three little eyes in addition to the large ones, placed generally on the top of the head, although they occasionally vary their position.

All insects are provided with *antennæ*, which are those little, many-jointed projections extending from the head near the eyes somewhatlike reindeer's borns. These are probably used for feeling, smelling, and hearing with, although their uses have not been definitely settled. They vary much in appearance; sometimes resembling Indian clubs, sometimes fringed like a fir tree, notched like a saw, plumed like a feather, or armed with teeth like a comb. A few insects have no wings, others have two, others four, but none have more than that number.

Insects pass through several stages of existence before they become fully developed. Most of them are hatched from eggs; then they pass into the larva state, in which ther are caterpillar, maggot, or grub, according as they are to become butterfiy or beetle. In course of time they go into pupa, or mummy state, from which they emerge ready for action as perfect insects. In some classes these destinctions are not so trongly marked.

On examining a fiy with a microscope, you will find six legs, armed each with two sharp little toes; two big compound eyes covering nearly the whole of the head, and the three little eyes arranged in a triangle; two transparent wings strengthened by a net-work of veins, and covered with fine hairs to protect them from wear and tear; a pair of tiny winglets, and on each side of the body a little knob which serves for unknown purposes. On closer examination of his mouth you will find a proboscis or trunk, like an elephant's; this in nothing but the lower lip lengthened and armed with three lancets, with which it punctures its food, or exasperates bald-headed old gentlemen. The end of the lip is flattened and grooved like the bottom of a meat dish for gravy. He is provided with a fiuid which running down little canals in his trunk, dissolves soluble substances, so that they are easily sucked up through the same little canals.

On examining the foot closely under the microscope you will see that it is armed with two little claws, protected by fleshy pads, covered with hairs. Each hair is enlarged at the end, making a little disk, which is kept moist by a fiuid continually exuding. The little claws catch on the rough point of any surface, and the moment this is done, the little disks take hold by their edges, while their centers are retracted, leaving a vacuum, and thus creating an atmospheric pressure which sustains the insect against the force of gravitation While one foot is raised, the others retain their hold, and the rapid movement of the six legs along a ceiling, shows how swift is the instinctive action of this complex apparatus.

According to Kirby and Spence, the common house fiy, when undisturbed, makes six hundred strokes with its wing in a second, and when necessary can increase its velocity sixfold.

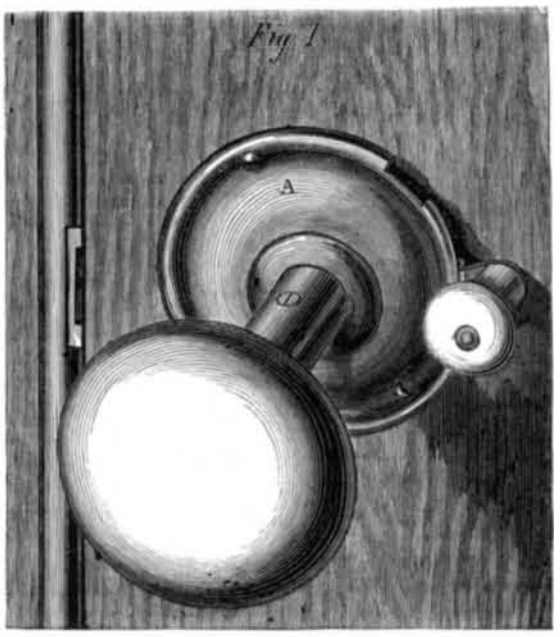
There is one fact in the natural history of flies that is generally very little understood, and what is true of fiies, is eqnally true with regard to all insects. It is that fiies hatched into the winged state never grow any more, either smaller or larger. If he is hatched a small fiy, small he remains all the days of his life. His growing and most of his eating, has been done in the larva or maggot state. Then he leads the life of a glutton, eating with apparent relish all most loathsome things, reveling in all sorts of impursties, waxing very fat and aldermanic, as do most large eaters in the human tribe. An old writer well observes, "How few of us are aware that all these creatures now buzzing above our heads once crawled beneath our feet!"—*Riverside Magazine.*

RICHARDSON'S PATENT LATCH FASTENER.

The subjoined engravings represent an improvement in mortise stop latches or locks, for which Letters Patent were issued to F. A. Richardson, of Poultney, Vt., Oct. 23, 1866.

The hardware trade has long felt the want of a mortise stop latch, something which should be simple, and at the same time effectual. More properly speaking it is a patent rose. When applied to a mortise latch, it renders it a perfect lock; for no person from the outside can possibly open the door. It will also be seen to be free from troubles hererofore existing in previous devices for fastening doors, inasmuch as it cannot in any case fasten itself, is perfectly simple, costs much less than the ordinary mortise latch and lock, and is free from the objections to the same for sleeping apartments.

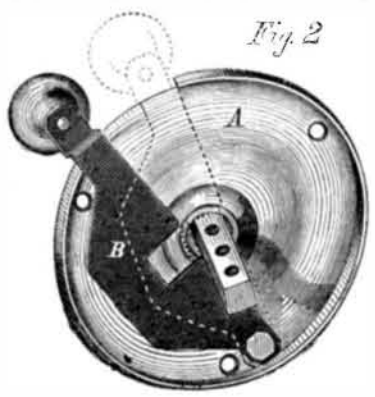
Fig. 1



The following are some of its advantages: 1. Its cost, as before stated. is much less than ordinary fastenings; 2. Its simplicity renders it less liable to get out of order; 3. It cannot be easily picked; 4. There is no key to be lost; 5. It is easy of adjustment and an ornament to a door; 6. It can be applied to any mortise latch or lock already on doors with very little expense.

The operation is as follows: Fig. 1 represents the inside of a door and casing, attached to which is a common mortise knob latch. Figs. 1 and 2, A, is a metal rose or washer of the usual construction, only made a little deeper in order to receive the stop, B, Fig. 2, which is made of steel, and fastened to the rose at one end by a rivet in a manner to allow it to move freely. The stop is bent slightly toward the rose before it is riveted on in order to keep it pressed up against the rose so that it will remain fastened when pushed up in place into

Fig. 2



the upper notch. It is also bent up or necked at the end, Fig. 2, to prevent its touching the door when moved up or down, thereby not marring the paint or door. The stop has a recess or notch in it, as shown in Fig. 2, to receive and hold firmly from turning the knob shaft. On the necked end of the stop is a small knob, either porcelain or mineral, to correspond with the door knob. It is by this small knob that the stop is worked. The rim of the rose has two notches to hold the stop in its place when pushed up or down. It will be seen by Fig. 2 that by pushing up on the small knob the knob shaft is kept from turning.

For other information in regard to this invention, for specimens, for agencies, and for supplies, address Richardson & Holbrook, at Poultney, Vt., or at 73 Cornhill, Boston, Mass.

Treatment of Magnetic Iron Ore.

The smelting of this important ore, which is found in large quantities in many of the Southern and Western States, has not been carried on with sufficient energy, on account of the great expense in labor and fuel connected with the process. At present it is for these reasons impossible to manufacture iron in any of the Southern and Western States that are too far distant from the coal regions. In a recent interview with Mr. A. Thoma, who for a considerable time was a superintendent of iron works in Russia, Germany, and Asia, he described a process invented by him by which the iron can be produced with but little trouble and with a saving of from 50 to 75 per cent of labor and fuel. The invention, if it proves to fulfill what it promises, will be of the greatest advantage to all iron manufacturers in the United States, and parties interested in the business would do well to convince themselves of its merits.

The inventor, Mr. A. Thoma, is desirous of finding somebody to take an interest in the matter. and to aid him in bringing it into general use. He can be addressed at No. 85 Sixth street, New York City.

MACHINERY FOR CUTTING STONE AND TUNNELING.

While in nearly every branch of industry that man s hand has found to do, his ingenuity has devised important mechanical aids, no machinery, excepting of the most primitive character, has ever been employed in the cutting and working of stone for ornamental or building purposes, and to this cause alone, rather than its original cost at the quarry, or even the expense of transporting to market, is due its great value as a building material. An English exchange describes an invention lately introduced for cutting rock and working up stone so economically, that it anticipates in time a decided decline in the fabulous value now attached to brown stone or marble fronts.

This machinery may be variously applied, as for sawing blocks and slabs of considerable thickness; for facing the surface of squared-up stone in an ornamental manner; for tunneling and undercutting stone, coal or slate *in situ;* also, for the vertical cutting of the living rock almost as readily as a hay cutter cuts hay out of a stack. The main efficiency of the machine depends on the peculiar forms of the cutting tools or movable teeth. These are attached to holders, which are themselves fixed either in the edges of the blade, an improvement on the plan of making the blade serve as a cutting edge; or are applied to the circumference of cylinders, when used for surfacing. In consequence of being movable in their sockets, these tools are easily replaced as required, without any reduction in the diameter of the blade, a fault which so soon renders the circular saw when applied to the cutting of stone or slate, useless.

In working up stone in the rough, the slate or massive block is clamped to a table which, moving on friction pulleys, is fed forward by a self-acting screw, advancing upon the cutting blades at a speed of from three to six inches per minute. The cutting blades, from one to four in number, are fixed to collars which traverse at an angle above the table, supported by uprights and moved by a train of wheels in the usual manner. For cutting window sills, door posts, steps, coping stones and a host of other building materials out of rough blocks of slate—which formerly were thrown away as useless because no means for working them was known—four blades of four feet diameter are employed, and blocks fourteen inches thick, weighing several tuns, are simultaneously reduced to five thick slices, and are immediately split into the thickness required for planing or tooling, as most suitable.

For giving a finished surface to building or other stone of an ornamental character, where breadth not depth is to be cut, the axle itself, or a removable cylinder bolted to the axle, receives the tools which are placed spirally around it, so that a divided and regular pressure may come upon the face of the stone at intervals of two or three inches. Fluting, waving or running figures are produced at pleasure by having the table carrying the stone travel on rails or grooves correspondingly curved. A roughing tool imitates the marks of a pickax in rustic stonework, with the usually chiseled work around it. Some patterns of flat tooling by these machines can be made to imitate chisel work so closely as only to be distinguishable by the finer finish given by the machine.

For quarrying stone a new principle is claimed to have been introduced in this machine. The cutting tools, instead of being placed in a single row around the rim of a thin blade, are fixed in rows of twos and threes alternately across the margin of a wheel-like disk, so as to clear away a wider space. The outer portion of this disk is a ring of cast iron armed on the outside with tools and carrying an ordinary cog wheel within; a pinion meshes into that part of the inner cog wheel that is continually furthest from the rock. This cogged wheel has as its axis a broad metal plate of great strength and forming four-fifths of the diameter of the entire cutter. In a circular saw with a central axis, the blade can only penetrate to so much of its semi-diameter as is clear of the axle and collar. But this arrangement allows the cutter wheel to be buried in the cut up to the point at which it is held, and practically a cutter three feet four inches in diameter enters the rock to the depth of two feet three inches. Parallel cuts having been made, the rock between is got out by blasting, or if there is any cleavage or layering, it may be wedged up from below.

These machines are extensively used in Wales, and in England a gigantic one, having two blades of thirteen feet diameter each, has been put up at South Shields, by the Commissioners of the Tyne Navigation, for cutting the limestone of the vicinity for the harbor works, and the success attending their working so far induces the belief that a really valuable acquisition has been made in these machines.

CURRENT RECIPES.

MODELING CLAY moistened with glycerine, is recommended for all the qualities of wax except expensiveness and susceptibility to changes of temperature. The clay must first be perfectly dried.

CLEANSING CASKS BY FIRE, is a cheap, short and effectual mode much in use in some parts of the world. Rancid pork, lard and butter casks, may be purified by burning straw or shavings in them.

DULL BLACK ON BRASS is obtained by rubbing the surface first with tripoli and then washing it with a solution of one part neutral nitrate of tin with two parts chloride of gold. After ten minutes wipe it off with a wet cloth.

TO WASH CALICO WITHOUT FADING.—Infuse three gills of salt in four quarts of water; put the calico in while hot, and leave it till cold, and in this way the colors are rendered permanent, and will not fade by subsequent washing.