WOODPECKERS.

The peculiar characteristics of the woodpeckers are the construction of the beak, the feet, and tail. The beak is constructed for chipping away the bark and wood, the feet giving them the power to hold fast to the trunk of the tree, and the tail to support them in position, which gives to their strokes the greatest force. Their beaks are long, powerful, straight, and pointed; their feet, formed for grasping, are set far back upon the body; their tails are short and stiff, and act as props when pressed upon the rough bark. Woodpeckers were for a long time thought to be injurious to trees, but that prejudice naturalists now agree was wholly an error. Often, in walking through the woods or orchards, there will be seen strewn in profusion, at the foot of a tree, flakes of bark and chips of wood, sure signs of the woodpecker's industry. It looks as though a work of destruction was being carried on, but these flakes, having become separated from the living bark of the tree, were mere excrescences under which insects and their larvæ found shelter, and to obtain them for food the woodpecker removes the dead flakes of bark and wood, so that in reality, instead of being an enemy to the farmer, he is one of his most faithful servants.

The woodpecker makes its nest in a tunnel which it excavates in the *unsound* timbers. Water, when admitted to a tree, causes its center to decay; but if a perforation is made through the trunk, gallon after gallon of dark brown water will rush out, mixed with fragments of decayed wood, showing the extent of the damage done. This often occurs when a branch has been blown off close to the trunk; the woodpecker is quick to discover it, and begins to cut a tunnel.

WOODPECKERS.

Wilson and Audubon both state that many of our woodpeckers will excavate tunnels in apparently sound and undecayed wood, boring through several inches, till they reach the decayed portions of the center of the tree.

The burrowing powers of the great giant gray-bellied woodpecker are marvelous, its chisel-like beak having been known to chip splinters from a mahogany table, and to cut a hole fifteen inches in width through a lath-and-plaster partition. Even the small downy woodpecker is able to bore its way through solid wood of a tree, making an ingenious nest, the burrows sloping for some six or eight inches, then being driven perpendicularly down the tree. The tunnel is barely wide enough to admit of the passage of the body of the bird. But the perpendicular hole is roomy, and is fitted up in a style sufficient to dignify it with the name of a chamber. The male and female woodpeckers labor alternately in the burrowing and making of the nest, but they find an implacable enemy in the saucy little wren, who, when the woodpeckers' apartments are ready for occupancy, coolly takes possession, and holds them against the builders and proprietors, notwithstanding their vehement and noisy expostulations.

Picus principalis is distinguished by a superb red carmine crest and bill of polished ivory. This is indeed no common bird, but is a king among his kind. No fence rails for him to perch upon, but rather the tops of lofty trees, the giant pines of the cypress swamps, where the trumpeting notes and loud strokes awaken and reawaken the echoes. From the base of some of these enormous pine trees cartloads of bark have been removed, and the trees so perforated with holes that it would seem to be impossible that it was the work of birds.

The Sense of Hearing.

Some observations on hearing have been lately recorded, which suggest striking analogies between that sense and vision. Herr Urbanttschitsch, in *Pfluger's Archiv*, indicates a way of demonstrating "fatigue" of the ear. Two tubes having been adapted to the ears so that a given sound equally affects the latter, a strong tuning fork is vigorously sounded and brought to the mouth of one tube for a few seconds. It is then deadened somewhat, but not wholly, by touch. The ear on that side then fails to catch the weak sound, but if the fork be brought to the other tube the sound is heard distinctly. The fatigue passes off in two to five seconds. A weaker tone of different pitch from the strong one is heard equally with both ears. Again, the same author has experimented with regard to subjective sensations of sound occurring after a strong tone has been heard for a little. The after sensation may come close upon the other, or be separated from it by a short pause. In the latter case (the only one studied as yet by the author) the pause varies up to fifteen seconds; then the sensation is revived, generally for five to ten seconds, then a pause and a renewal of the sensation, etc. Some persons have only one after sensation, while others have as many as six or eight. The time thus occupied (from cessation of the objective tone) is seldom over two minutes. A correspondent of the Cleveland (Ohio) *Leader* has described some experiences of his own in hearing, which remind one of color blindness. Certain sounds he never hears—*e. g.*, the song of birds. A room might be full of canary birds all singing, but he would never hear a note, though he would hear the fluttering of their wings. Nor does he hear the hissing sound of the human voice. He was taught to make it, and he never makes it without effort. About a quarter of the sounds of the human voice he fails to hear; and he has to be guided a good deal by the motion of the lips and the sense of remarks made. The upper notes of musical instruments he misses, but he hears the lower ones. In the Pennsylvania Medical Society, once more, Dr. Turnbull has recently called attention to the danger to life and property arising from deafness on the part of railway men, a considerable minority of whom have ear affections resulting from the conditions of their work. After citing personal observations and the evidence collected by Moon and Hirt, he recommended that all candidates for railway service should be carefully tested as to hearing by the company's physician, who should also report to the superintendent each case of deafness discovered in locomotive men, so that they might be transferred to positions where perfect hearing is less important.

Prophylactic Inoculation of Germs.

Prophylactic inoculation, which has been so carefully investigated in France, was the subject of communication by Grawitz to the recent Surgical Congress at Berlin, which dwelt also with the question of the transformation of innocent into deleterious organisms. Fungi which grow in bread, milk, etc., develop in an acid medium and at the ordinary temperature. Inoculated in an animal, they rapidly die, being in uncongenial conditions; but by successive systematic cultivation Grawitz has succeeded in acclimatizing the fungi in a medium, such as the blood, of a decided alkaline reaction, and at a temperature of 37° C. They are found to have then become infectious germs, the degree of their deleterious action being proportioned to their power of adaptation to their new conditions of existence.

Inoculating rabbits with the products of cultures more and more perfect, Grawitz has noted a progressive increase, not only in the intensity of the disorders thus produced, but also in the localization of the local lesions. As soon as the spores are sufficiently adapted to the conditions of the blood, they become established in the kidneys and in the liver, accumulating in foci, and causing swelling of the organ, and fatty degeneration of the cells. With still more highly developed products of culture, colonies of parasites are met with in the muscles, then in the intestines, in the spleen, and, finally, in the brain and lungs. Grawitz, like the French observers, has also found that the inoculation either of large doses of fungi of low "culture," or of smaller quantities of the organisms which have acquired more deleterious properties, will confer an immunity against future more virulent inoculations. Inoculation with uncultivated spores, not suited to the animal organism, confers no immunity.

Grawitz attempts to explain these facts by the following theory. The organs are invaded by colonies of organisms, in the order of the functional activity of their cells, taking as the measure of that activity the consumption of oxygen in a given time. He speculates that the germs in contact with the anatomical elements of the organism attack first those which have the least vital power of resistance, and somewhat fancifully suggests that the tissue elements, if successful in the struggle, acquire an increased power of resistance, which they transmit to their successors.—*Lancet.*

The Phylloxera in France.

Mr. C. H. Perceval, H. M. Consul at Bordeaux, reports as follows:

"The information which I have gathered on this subject, from official and other sources, tends to reduce the methods used to the following three: First, submersion of the vineyard, when practicable; secondly, by employing insecticides; and, thirdly, where the vineyards have been destroyed, by the plantation of American varieties of vines, whose roots offer more resistance to the attack of the insect. M. Armand Lalande, the President of the Chamber of Commerce of Bordeaux, proprietor of extensive vineyards in the Médoc, a gentleman to whom I am much indebted for the information and assistance which he has been kind enough to afford me in drawing up this report, addressed a meeting of that body held in March last on various topics, and I translate the following from his remarks regarding the phylloxera: 'The Chamber of Commerce has not ceased to show the extreme importance which it attaches to all the means employable in combating this dreadful scourge. Of the 2,200,000 hectares which composed the vineyards of France, 500,000 are destroyed, 500,000 others are greatly attacked; it is a loss of more than three milliards to the country. The Gironde is one of the departments which has suffered most; one third of the vineyards are destroyed, another third is badly attacked. We must admit, with sorrow, that the very sources of our commerce and of the well being of our southern population are most seriously compromised. Still we have great hopes that, by energetic and intelligent efforts, we may be enabled gradually to arrest and repair the evil. For the very important vineyards of the Gironde, where submersion is possible, it is a sure remedy, which is generally employed, and with invariable success. In the cases of vineyards already destroyed, the remedy seems to be to reconstitute them by planting American vines as stocks for grafting French cuttings on, which plan has been the subject of satisfactory and conclusive experiments for the last few years, especially in Languedoc. Where the vines are not too far gone, a judicious use of sulphur of carbon is a certain means of preservation, and, in most cases, practicable, owing to the moderation of the cost.' "

The Mississippi and Tributaries.

A pamphlet on the Mississippi River and its tributaries gives the following statement of the mileage of the navigable portion of each of the following-named rivers above its mouth: Missouri, 3,129; Mississippi, 2,161; Ohio, 1,021; Red, 986; Arkansas, 884; White, 779; Tennessee, 789; Cumberland, 900; Yellowstone, 474; Ouachita, 384; Wabash, 365; Allegheny, 325; Osage, 363; Minnesota, 295; Sunflower, 271; Illinois, 270; Yazco, 226; Black (Ark.), 112; Green, 200; St. Francis, 180 Tallahatchie, 175; Wisconsin, 160; Deer Creek, 116; Tensas, 112; Monongahela, 110; Kentucky, 105; Bartholomew, 100; Kanawha, 94; Muskingum, 94; Chippewa, 90; Iowa, 80; Big Hatchie, 75; St. Croix, 65; Rock, 65; Black (La.), 61; Macon, 60; Bœuf, 53; Big Horn, 50; Clinton, 50; Little Red, 49; Big Cypress and Lake, 44; Big Black, 35; Dauchitte, 33. Total number of rivers, 33; total number of miles of navigation at present, 15,710.

A Balloon Experiment.

After waiting several days for favorable weather, Prof. King's balloon, "Great Northwest," was started on its way to the East from Minneapolis, Minn., September 12. Prof. King was accompanied by Mr. Upton, of the Signal Service, and five newspaper correspondents. The balloon rose about 3,000 feet, and drifted slowly in a southeasterly course. It dropped near Fort Snelling, and nearly fell into the Mississippi River. A liberal discharge of ballast secured another ascent, but a brief one, and the balloon came to ground in the woods near St. Paul. When the wind rose it was deemed too violent, and the project was abandoned.

Passenger Birds.

According to a writer in *Nature*, the small migratory birds that are unable to perform the flight of 350 miles across the Mediterranean Sea are carried across on the backs of cranes. In the autumn many flocks of cranes may be seen coming from the north, with the first cold blast from that quarter, flying low, and uttering a peculiar cry, as if of alarm, as they circle over the cultivated plains. Little birds of every species may be seen flying up to them, while the twittering songs of those already comfortably settled upon their backs may be distinctly heard. But for this kind provision of nature, numerous varieties of small birds would become extinct in northern countries, as the cold winters would kill them.

Natural Gas in Iron Works.

A correspondent of a Pennsylvania paper thus describes the use of natural gas in the Kittanning (Pa.) Iron Works. The gas is brought from a well some three miles distant, in four inch casing, and at the mill is distributed among eighteen boiling furnaces. The furnaces are the same as those in which coal is used. The gas enters the rear of the furnaces in three small pipes, shaped at the end like a nozzle. There being quite a pressure, the gas enters with considerable force, and by means of dampers to regulate the draught, an intense and uniform heat is obtained. After a heat the furnace is cooled and prepared for the next heat, in the same manner as with coal. When the metal is in place the gas is turned on, and the operation of puddling is the same with the exception that it is somewhat slower.

The puddlers like the gas very much, as it reduces their labor to some extent, and they say they can make better weight than with coal. The furnaces being free from sulphur, a better quality of iron is produced, and it brings a slightly advanced price in the market. These furnaces have been running all the time for some months past, and have used nothing but gas for fuel, which has proved satisfactory in every respect, is found to be much cheaper than coal, and has demonstrated the fact that this vast amount of natural gas, now going to waste, might be used in all our iron manufactories.

Mr. R. L. Brown, having purchased another and larger well, has organized a stock company, and is about negotiating for the erection of a steel works, to be run with gas. Mr. Brown claims that he has a process by which he can manufacture steel of a superior quality and with less expense than by any process now in use.

Should this latter enterprise prove a success, the same parties who have control of the old Cowansbannock gas well propose to erect glass works, and will apply the gas to the manufacture of glass.

The gas which I have referred to as supplying the boiling furnaces is brought, as I said, a distance of three miles west of Kittanning, in East Franklin township, about ten miles from any oil development, the nearest oil well being at Great Leather. The gas well was put down two or three years ago as a test well for oil on the Reed farm; and was left to burn and go to waste until Major Beale and others bought the well with the idea of making lampblack. But the mill proposed to utilize it for fuel, and it has done so with the most satisfactory results. Only one half of the well's production is in fact consumed by the eighteen furnaces here described.

Notes on Wheel Making.

The first thing that gives way on a buggy is commonly the wheels. I have frequently seen new buggies go out of the shop, and before they had been out a dozen times the spokes would commence to squeak and work in the hub, or one or more of the wheels would dish back. The question then arises, is the woodworker to blame, or is it the carelessness of the smith in setting the tire, or does the fault lie in the selection of the timber used in making the wheels? Let us try and see where the trouble lies.

In the first place, the manufacturer may make a grand mistake in the selection of his timber. Some have an idea that they must have good spokes any way, but are not so particular about the hub or rim; while others must have the hardest hub they can find, saying: "I have got a fine set of hubs, but mixed or forest growth spokes will do well enough." Now we will see how such wheels turn out. We find, after they have been run a short time, that around the mortise of the hub the paint is cracked, the dish is out of the wheel, and the owner of the buggy is mad enough to kill the wheelmaker and blacksmith, and swears he never will pay the balance due on that buggy until he puts on a new set of wheels.

Well, the carriage maker goes to work and puts in a new set of hubs that he happens to have in the shop of much softer timber than the first ones. He thinks these are good enough, but gets the best second-growth spokes he can find. The new wheels are finished, but in a short time they work just the same as the first.

Now the difficulty in the first set was a soft spoke driven in a hub as hard as iron; while, in the second case, a hard spoke was driven into a soft hub. Point first: Care must be taken to have the hub and spoke of the same hardness. Point second: A tolerably good set of wheels can be made out of softer timber, providing this rule is observed.

Next, wheels should be made with the spoke driven straight, and the tenon on the spoke should have but little taper, as by driving spokes like a wedge into a hub they are more liable to work back and get loose.

In regard to the rims, great care should be taken not to have them too long, for this prevents the tire from supporting the wheel.

A great deal has been said in the *Hub* about the proper dish of a wheel, some claiming one-half of an inch, while others claim that one-fourth of an inch is sufficient. A wheel with but little dish looks well to the eye, but my experience has been that three-quarters of an inch is not too much to make a durable wheel. SCOTT SMALLWOOD.

Chicago, July 23, 1881.

Statistics of Cotton.

The report of Census Agent Eugene W. Hilgard, just submitted, shows the acreage and production of cotton by States for the year 1879, as follows:

States.	Acres.	Bales.
Mississippi	2,093,330	955,808
Georgia	2.617,138	814,441
Texas	2,173,732	803,642
Alabama	2,330,086	699,654
Arkansas	1,042,976	608,256
South Carolina	1,364,249	522,544
Louisiana	864,787	508,569
North Carolina	893,153	389,598
Tennessee	722,569	330,644
Florida	245,595	54,997
Missouri	32,711	19,733
Indian Territory	35,000	17,000
Virginia	24,900	11,000
Kentucky	2,667	1,367

The average product per acre in pounds was:

States.	Seed Cotton.	Lint.	Cotton Seed.
Mississippi	651	217	434
Georgia	444	148	296
Texas	528	176	352
Alabama	429	143	286
Arkansas	831	277	554
South Carolina	546	182	364
Louisiana	837	279	558
North Carolina	621	207	414
Tennessee	651	217	434
Florida	318	106	212
Missouri	861	287	574
Indian Territory	693	231	462
Virginia	654	28	436
Kentucky	729	243	486

Rain in the United States.

Mr. Henry Gannett, geographer of the tenth census, has issued a report showing the distribution of rain-fall throughout the United States and the distribution of population according to rain-fall. It appears that the highest annual rain-fall in the country has been 150 inches, which was reached for one year only in Puget Sound. The average annual fall upon the surface of the United States, exclusive of Alaska, was, in 1880, 29 inches. This average implies a large area unfit for the purposes of vegetation, which with the rapid evaporation that occurs on this continent, requires a much higher ratio of moisture. Hence, population is found to center principally on such parts of our surface as have from 35 to 50 inches of rain. The following table from Mr. Gannett's compilations will show the relation between rain-fall and number and density of population in the United States in 1880:

Inches of Rain-fall.	Population.	Pop. per Sqr. Mile.	Percentage of total Population.
60 and above	855,680	12·4	1·70
55–60	2,813,866	19·7	5·61
50–55	4,311,502	22·1	8 60
45–50	12,754,479	57·7	25·43
40–45	11,357,292	40·1	22·65
35–40	10,057,170	38·6	20·05
30–35	4,993,336	23·0	9·96
25–30	1,179,136	8·7	2·35
20–25	829,340	3·8	1·65
15–20	537,323	1·3	1·07
10–15	309,438	0·6	1·62
Below 10	154,304	0·6	0·31

The heaviest population is in the classes between 35 to 50 inches, which comprise $71\frac{69}{100}$ per cent of the total population of the country, while the classes between 30 and 60 inches comprise $92\frac{2}{10}$ per cent of the population. The densest settlement is in the class 45 to 50, which also contains the greatest absolute population. In this class also is the greatest absolute increase in density. A rain-fall of 45 to 50 appears to best suit the purposes of wealth-making; for a larger number of our people have settled within an area having that fall than in any other. From the data above given, we reckon that the total rain-fall in the United States, exclusive of Alaska, in 1880, was 414.999,040,307,660,000 cubic inches, or 1,796,532,642,000,000 gallons, which is about double the water contents of Lake Erie and Lake Ontario combined, these lakes containing 893,158,008,000,000 gallons. This will afford some idea of the extent of the evaporation effected on our 3,026,494 square miles of surface within twelve months.

MECHANICAL INVENTIONS.

An improvement in pistons has been patented by Mr. Henry Waterman, of Brooklyn, N. Y. This improvement relates to pistons having their main portions formed by expansible rings carried by a central hub and face plates. The invention consists in the combination, with these essential portions, of devices that give solid and adjustable backing to the rings; also, in a metallic packing disk for the joint between the face plate and rings.

Mr. William P. Brosius, of Richmond, Va., has patented a seam gauge for determining the amount of lap in sewing together two pieces of leather in the manufacture of boots and shoes, or in connecting parts of any other material, so that a uniform amount of lap is preserved and the line of stitching kept at the proper distance from and in parallel position with the edge. It is an improvement in that form of gauge in which a guide face is arranged to rest in the plane of one of the sections of work and bear against its edge, and a second guide face is arranged in the plane of the other sections of the work and is arranged to bear against the other edge, and the distance between which two faces may be varied to regulate the width of the lap.

An improved nut lock has been patented by Mr. John B. Abernathy, of Covington, Ky. The invention consists in a nut provided with a threaded central recess or cavity in its upper surface to receive a central threaded projection of a second nut, which is screwed on the bolt after the first nut, the threads of the projection taking in those of the cavity, thus uniting the two nuts.

Mr. Samuel W. Evans, of New Orleans, La., has patented an improved apparatus for holding a hose nozzle in any position, thereby enabling a person to direct a stream of water in any desired direction. The invention consists in a ring or sleeve for receiving the nozzle, and provided with trunnions journaled in uprights of a plate swiveled on an upright pivoted to a folding base frame, provided on the under side with spikes to prevent it from slipping.

Gelatine Emulsion.

Mr. A. L. Henderson, of London, lately gave a demonstration of the method of preparing a gelatino-bromide emulsion he has for some time past been working with great success. The following is his formula and method of working:

Make a solution of 200 grains of silver nitrate in 4 ounces of water, then add sufficient ammonia to redissolve the precipitate thus formed (about 2½ drachms of ammonia are requisite for this purpose). This solution of ammonia nitrate of silver is now heated to about 100° Fah., and the following solution, also heated to about the same temperature, is poured slowly into it (the mixture being stirred with a glass rod meanwhile): Gelatine, ½ ounce; ammonia-bromide, 150 grains; ammonia, 2 drops; water, 4 ounces.

The emulsion is now cooled as rapidly as possible, and then forced through a fine gauze disk, and washed by means of a stream of water. The emulsion thus obtained is of a grayish-blue tint, of a very fine grain, and extremely sensitive. The rapidity is increased in the same proportion as the silver nitrate is converted into ammonia nitrate, thus (for example), if 20 per cent only is converted into ammonia nitrate, the plate will not be nearly as rapid as if the whole, or nearly the whole, of the silver is converted.

Another important point in this process is that the bromide of silver is formed in an excess of silver, thereby giving greater rapidity and density.

This emulsion is so rapid that even an Edwards lamp with a ruby chimney (that will stand the spectroscopic test) and two thicknesses of ruby paper is not too safe a light.

The emulsion may be converted into pellicle by pouring it slowly (after washing) into three times its bulk of alcohol, stirring meantime. The precipitated emulsion will cling round the rod in a spongy form, but by a little working with the hand the whole will be reduced to the size of a walnut. It must then be torn into small pieces and dried in a current of air. The weight of this quantity, when thoroughly dried, will be about 6 drachms.

This pellicle will keep an indefinite time, and when wanted for use has only to be redissolved in 10 to 12 ounces of water, and strained, when it is ready for coating.

Photo Substitute for Glass.

Professor Stebbing, of Paris, has made a new film substitute for glass plates, which has been laid before the French Photographic Society. The basis of the support is gelatine, rendered insoluble, and the tissue is of such thickness as to be easily handled even when wet, without the slightest danger of injury. It is pliable and "leathery" in its character, thus obviating any tendency to fracture from accidental bending as would be the case possibly if the gelatine were more brittle. The development of these film negatives is extremely simple. It is first of all necessary to take means to prevent the developing solution from passing between the sensitive film and the support. This is effected by drawing the edges of the undeveloped tissue between the thumb and forefinger, which have been previously slightly greased with tallow. The film is then laid in a dish and developed in the ordinary way. When the action of the developer is complete the solution is poured off and the negative washed while still in the dish; in fact, the whole of the operations are performed in the one dish, so that the film is submitted to as little handling as possible. After a short immersion in chrome alum the negative is finally washed and spread upon a sheet of glass to dry. Here the great difficulty previously experienced in getting the films to dry flat has been