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BIRDS AND ALL NATURE.

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FORESTS.

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FORESTS.

JOHN M. COULTER, PH.D.
Head Professor of Botany, University of Chicago.

FORESTS have always been admired, and in ancient times they were often considered sacred, the special dwelling-places of gods and various strange beings. We can easily understand how forests thus affected men. There is a solemnity about them, a quiet grandeur, which is very impressive, and the rustling of their branches and leaves has that mysterious sound which caused the ancients to people them with spirits. We still recognize the feeling of awe that comes in the presence of forests, although we have long since ceased to explain it by peopling them with spirits.

Once forests covered all parts of the earth where plants could grow well, and no country had greater forests than North America. When America was discovered, there was a huge, unbroken forest from the Atlantic west to the prairies. Now much of this has been cut away, and we see only small patches of it. Men must use the forest, and still they must save it, and they are now trying to find out how they may do both.

Forests are sometimes almost entirely made up of one kind of tree, and then they are called "pure forests." Pine and beech forests are examples of this kind. More common with us, however, are the "mixed forests," made up of many kinds of trees, and nowhere in the world are there such mixed forests as in our Middle States, where beech, oak, hickory, maple, elm, poplar, gum, walnut, sycamore, and many others all grow together.

Probably the densest forests in the world are those in the Amazon region of South America. So dense are they that hardly a ray of light ever sifts through the dense foliage, and even at noon there is only a dim twilight beneath the trees. The tallest forests are the Eucalyptus forests of Australia, where the trees rise with slender trunks to the height of four or five hundred feet. But the largest trees in the world, when we consider both height and diameter, are the giant "redwoods" (Sequoias) of the Pacific coast. All concede, however, that the most extensive, the most varied, and the most beautiful forests of the world are those of the Atlantic and Middle States.

Perhaps it is well to understand how a tree lives, that we may know better what a forest means. The great roots spread through the soil, sometimes not far from the surface, at other times penetrating deeply. The young root tips are very sensitive to the presence of moisture, and turn towards it, no matter in what direction it may carry them. In penetrating the soil the sensitive root tips are turned in every direction by various influences of this kind, and as a result, when the

root system becomes old, it looks like an inextricable tangle. All this tangle, however, but represents the many paths that the root tips followed in their search for the things which the soil contains.

Roots are doing two things for the tree: They anchor it firmly in the soil, and also absorb material [Pg 98] that is to help in the manufacture of food. It is the older roots that have long since stopped absorbing that are the chief anchors. How firm this anchorage must be we can, perhaps, imagine when we think of the strain produced by a great crown of leaves swaying back and forth in the wind. It is only a cyclone that seems to be able to overthrow a sound tree, and then it more commonly breaks its trunk than uproots it.

The very important work of absorbing is given over to the very young roots; in fact, chiefly to those of this year, for new rootlets must be put out each year. These roots can only absorb water, so that if they are to get anything from the soil it must be something that water will dissolve. In this way the water is used as the carrier of soil-material into the root. Just how this water carrying soil-material gets into the root is not easy to explain, for the root has no holes to let it in, and it must pass through living walls. That it does enter, however, every one knows. It is evident, therefore, that the root is supplying to the tree two kinds of raw material for food manufacture obtained from the soil, namely, water and soil-material dissolved in it.

But the tree does not obtain all its raw material from the soil. A very important material is taken from the air, the material commonly called "carbonic acid gas," the same material that we breathe out so abundantly from our lungs as one of our body wastes. This important material is taken out of the air into the plant chiefly by means of the leaves. Spread out as they are in the air, the leaves are in the most favorable position for doing this work.

But where and how are these three kinds of raw material manufactured into plant food? The leaves are specially constructed to be the chief seat of this food manufacture. The carbon gas is received directly into these manufactories from the air, but the water and the soil-material are down in the roots, and it is necessary for them to be carried to the leaves. As a consequence, a "current" of water containing soil-material ascends from the roots, through the stem, and is distributed through the branches to the leaves. This movement is generally known as the "ascent of sap." The path of this movement in the stem is through what is known as the "sap wood," and it is this very fact which gives to this region of the wood its peculiar character. Just how the sap ascends through the stem and reaches the leaves, no one knows. All of our explanations have proved unsatisfactory, and only those who are not fully acquainted with the facts claim to be able to explain it.

When the sap reaches the leaves, the water is no longer needed as a carrier of soil-material. Some of it is needed in the manufacture of food, but by far the greater part of it escapes from the leaves into the air by a process which may be called "plant evaporation." The amount of water thus brought from the soil and poured out into the air by active plants is very great; and when we consider a forest at work, we can hardly compute the vast amount of moisture which it is constantly contributing to the air during the growing season.

The three kinds of raw material thus brought together chiefly in the leaves are there manufactured into plant food. On account of this work the leaves have often been spoken of as the "stomachs" of the plant. This is a very incorrect and misleading illustration, for the work referred to is not digestion such as a stomach is concerned with, and, in fact, it is a process entirely unknown in animals, and found only in green plants. It is a wonderful process, which we do not at all understand, but it consists in taking this dead raw material from soil and air and manufacturing out of it living material. Not only does the food of the plant, and hence its life, depend upon this process, but all the life of the world, as we understand it, depends upon it. We know at least two prominent conditions of this process, for it seems evident that it cannot take [Pg 101] place without light and the peculiar green substance which gives the characteristic color to leaves. With the help of light and this green coloring substance, known as "chlorophyll," the living substance in the leaves is able to do this marvelous work.

The food thus manufactured is distributed throughout the tree, either to be used wherever growth is going on, or to be stored up. While we may say that there is an "ascending current" of sap through the sap wood, it is an error to say that there is a "descending current." The movement of prepared food has no definite channel, but it is drawn in every direction wherever needed.

If we now consider the parts of a tree all together, we may be able to get some notion of the meaning of their positions. The roots must be related to the soil to secure anchorage and raw material for food manufacture. The leaves must be related to the air and light to secure more raw material and help in doing their important work of food manufacture. The stem is simply to carry the leaves well up into the air and sunshine, and has no meaning except as it is related to the work of the leaves. In thus widely separating the roots and the leaves, the stem must act as a channel of communication between them.

In the tree trunks with which we are familiar, everyone has observed the concentric rings of wood that appear in a cross-section. These are usually spoken of as "annual rings," with the idea that one ring is made each year. In consequence of this it is the habit to estimate the age of a tree by counting these rings. Not infrequently it happens, however, that more than one ring may be made in a year, as a ring represents a single season of growth, and there may be more than one season of growth during a single year. It is much better to call them "growth rings," and to

recognize the fact that by counting them we may be overestimating the age of a tree.

One of the most noticeable things about the principal trees of our temperate climate is that they "shed" their leaves every year, being covered with foliage during the growing season and bare during the winter. This is known as the "deciduous" habit, and such trees are called deciduous trees, in distinction from "evergreen" trees. This is really a habit, brought about by the conditions in which trees of temperate climates must live. The leaves of such trees are broad and thin, fitted for very active work. When the winter comes, they would be entirely unable to endure it. The tree might protect them by giving them narrow forms and thick walls (as in pines), but it would be at the expense of activity during the growing season. It is more economical for the tree to make an entirely new set of leaves each year than to protect the old ones.

Perhaps the most noticeable feature in connection with the fall of the leaves is that so many of them take on a rich coloration. Our mixed American forest is the most brilliantly colored autumnal forest in the world, and there can be no landscapes richer in color than those which include such a forest. While all this should appeal to our sense of the beautiful, it should raise the question as to what it means in the life of the trees. We are not at all sure that we know, for we cannot as yet explain the conditions which cause the colors to be produced. We observe that they occur towards the end of the activity of the leaf, but that they are necessarily associated with cold, or drought, or certain outside conditions, is not at all clear. The colors are various shades of red and yellow, sometimes pure, sometimes mixed. It has been recently suggested that the red color is to serve as a protection. It is known that before the fall of the leaf the living substances are gradually withdrawn into the permanent parts of the tree, and that when these living parts cease to work they are peculiarly helpless. At this unprotected period the red appears, and this color absorbs enough heat from the light to raise the temperature, and so the needed protection against chill is afforded. This seems reasonable, but the whole subject of the meaning of plant colors is very obscure.

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Gen. Robert E. Lee was a great lover of forest trees. He owned a large and beautiful forest in northern Virginia at the time of the War of the Rebellion. While the army of Virginia was encamped near Fredericksburg, he was gazing at the great forest trees that beautified a homestead near by, the property of his companion. This companion quotes him as saying on this occasion: "There is nothing in vegetable nature so grand as a tree. Grappling with its roots the granite foundations of the everlasting hills, it reaches its sturdy and gnarled trunk on high, spreads its branches to the heavens, casts its shadow on the sward; and the birds build their nests and sing amid its umbrageous branches."

THE BRAVE OLD OAK.

A song to the oak, the brave old oak,
Who hath ruled in the greenwood long;
Here's health and renown to his broad green crown,
And his fifty arms so strong.
There's fear in his frown when the sun goes down,
And the fire in the west fades out;
And he showeth his might, on a wild midnight,
When the storms through his branches shout.

Then here's to the oak, the brave old oak,
Who stands in his pride alone;
And still flourish he, a hale, green tree,
When a hundred years are gone.

In the days of old, when the spring with cold
Had brightened his branches gray,
Through the grass at his feet crept maidens sweet
To gather the dew of May;
And on that day, to the rebeck gay
They frolicked with lovesome swains;
They are gone, they are dead, in the churchyard laid,
But the tree, it still remains.

Then here's to the oak, the brave old oak,
Who stands in his pride alone;
And still flourish he, a hale old tree,
When a hundred years are gone.

He saw the rare times when the Christmas chimes
Were a merry sound to hear,
When the squire's wide hall and the cottage small
Were filled with good English cheer.
Now gold hath the sway we all obey,
And a ruthless king is he;
But he never shall send our ancient friend
To be tossed on the stormy sea.

Then here's to the oak, the brave old oak,
Who stands in his pride alone;
And still flourish he, a hale, green tree,
When a hundred years are gone.

—Henry Fothergill Chorley.

"CHEEPER," A SPARROW BABY.

BY ANNE W. JACKSON.

ONE day in May, as I was hurrying along the street, my steps were arrested by the distressed chirping of a sparrow on the opposite sidewalk. Thinking that probably a young sparrow had fallen from the nest, I picked my way across the muddy road to the other side to see what I could do.

The poor little sparrow-mother was wildly hopping about and chirping in sore distress. And what a pitiful sight greeted my eyes! Upon the wet grass, under the very jaws of an evil-looking little black-and-tan dog, was a poor, draggled, shivering baby sparrow.

At sight of me the dog coolly picked up the baby and trotted off. I followed and he soon dropped it; but I couldn't succeed in driving him away. He still remained in sight, bold and impudent.

I was in a sad dilemma. Of the two evils which confronted me, or rather the baby, which would prove the less?

The trees all about the place were tall ones, with no low branches. There was no hope of returning the baby to its nest. It was too weak from cold and fright, as well as too young, to fly. If I left it the dog would certainly return and devour it before its mother's eyes.

On the other hand, if I took it home with me it would probably die under my ignorant care. However, I decided on the latter course, so clasping it close in my hand, continued on my way.

Those who have a continual grudge against the English sparrow will say, "Why all this fuss over a miserable little nuisance of a sparrow?" and think the wisest thing would have been to leave it to its fate. But the superfluity of the English sparrow is not the question in a case like this. When something weak and helpless is thrown across our path, it simply remains for us to help and save it, if it is in our power.

On the way home I pondered a good deal over the question of how I should care for it and feed it, and what I could find to keep it in, as I had no bird-cage.

When I got Master Sparrow home, and had thoroughly warmed him and dried his little feathers (they were very few!) I put him into the best substitute for a bird-cage that I could find, and that was a large wire rat-trap!

The next question was, what to feed him. As I had seen sparrows picking at the cornmeal which we mixed and gave to the little chickens, I ventured to put some of it into his cage.

I watched him a good deal, that day and didn't *see* him eat a morsel. But as he seemed stronger and more lively the next day, I concluded he was bashful and only ate when I wasn't looking.

Soon, however, he grew less afraid of me and would hop about and peck at his food when I was near. I began to vary his diet, too, and gave him what green slugs I could find on the rosebushes, as well as minced earthworms. He ate the slugs eagerly and seemed to enjoy tugging at wriggling bits of earthworm.

He also began to develop quite a voice and "cheeped" so loudly that I named him "Cheeper."

I grew very fond of him and watched him grow and feather out with great pride and interest. As he became stronger he grew more eager to get out of his cage. It quite went to my heart to see him beating against, the wires, and vainly striving for freedom. But I feared he couldn't take care of himself; and also that the other birds might not receive him well.

So I kept him seven days. I put his cage in the window several times where he could look out on the world and become acquainted with the colony of sparrows which inhabits the Virginia creeper covering the north side of our house. He would "cheep" very loudly on these occasions and try harder than ever to get out. His presence in the window made a great commotion among the other sparrows, who chirped excitedly and flew about, taking long looks at him. Two of them went so far as to alight on his cage.

On the seventh day, at noon, I took his cage to the window and set him free. He flew the length of the house and settled on a rosebush at the end of the porch, where he sat for some time, peering about, with his little head comically hoisting this side and that. Presently, when I came to the window to see if he were still there, I found he had flown away; and though I thought I could distinguish his particular "cheep" several times afterwards, I saw him no more that day. Nor did I expect to see him again. [Pg 104]

I missed him a great deal and was surprised to find how fond of him I had grown. Imagine my

surprise and delight when I went out next morning to feed the chickens to find little "Cheeper" there before me! He flew onto the fence when he saw me, but soon flew down again, and hopped about among the little chicks quite fearlessly. I was afraid the big chickens would step on him; and, sure enough, the Bantam rooster *did* walk right over him, but he just squawked and hopped away without any apparent resentment.

The next morning he was there again, when I went out. This time he followed a hen about, hopping along with her little chicks as though he thought himself one of them. He was such a fluffy little fellow, and he did look so tiny and cunning!

Poor little motherless baby, trying to find a mother in a big hen! That was the last time I saw him.

Only a despised little English sparrow! Yet, little "Cheeper," you had your mission in life. You made the heart of one bird-lover more tender by your helplessness, and your memory is dear to her.

THE HERMIT THRUSH.

NELLY HART WOODWORTH.

Does the thrush drink wild honey? a nectar distilled
From the flowers of the field, that his message is filled
With such sweetness? O'er the twilight 'tis ringing—
June's divinest refrain, 'tis a soul that is singing,
Oh, so trustfully sweet, rapture blended with pain,
Rings the silver bell softly, I hear it again,
And the wood is enchanted, uncertain it seems,
As some moment of waking, the dreams, oh the dreams!

Does he bathe evermore in the miracle springs,
That his wings and his heart are in rhythm when he sings?
Tears moisten the harpstrings, they quiver with pain,
Then the triumph, the peace but the finest souls gain—
Earth's losses, its tears through the notes sweep along,
The longings of earth find a voice in the song,
Till outechoed by angels they find a release,
To be silenced henceforth, merged in infinite peace.

Will the spirit bird sing through the ages to come,
Or the soul take its flight and, still singing, go home,
And the world weep aghast when, the music withdrawn,
The lark still a wing tells the rapture of dawn?

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GRAND CAÑON.

CHICAGO,
A. W. MUMFORD,
PUBLISHER.

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THE GRAND CAÑON OF THE COLORADO.

[From Major J. W. Powell's Report of the Exploration of the Cañons of the Colorado—1869.]

FOR two years previous to the exploration, I had been making some geological studies among the heads of the cañons leading to the Colorado, and a desire to explore the Grand Cañon itself grew upon me. Early in the spring of 1869 a small party was organized for this purpose. Boats were built in Chicago, and transported by rail to the point where the Union Pacific Railroad crosses the Green River. With these we were to descend the Green into the Colorado, and the Colorado down to the foot of the Grand Cañon."

From the record of May 24, 1869, we quote the following:

"The good people of Green River City turn out to see us start—a party of ten men. We raise our little flag, push the boats from shore, and the swift current carries us down."

"Our boats are four in number. Three are built of oak, staunch and firm."

"We take with us rations deemed sufficient to last ten months, abundant supplies of clothing, also a large quantity of ammunition and two or three dozen traps."

On the 26th they go into camp at the foot of the Uintah Mountains, at the head of Flaming Gorge Cañon, the first to be explored.

We quote again: "The river is running to the south; the mountains have an easterly and westerly trend directly athwart its course, yet it glides on in a quiet way as if it thought a mountain range no formidable obstruction to its course. It enters the range by a flaring, brilliant-red gorge, that may be seen from the north a score of miles away."

"You must not think of a mountain range as a line of peaks standing on a plain, but as a broad platform many miles wide, from which mountains have been carved by the waters. You must conceive, too, that this plateau is cut by gulches and cañons in many directions, and that beautiful valleys are scattered about at different altitudes. The first series of cañons we are about to explore constitute a river channel through such a range of mountains. The cañon is cut nearly half-way through the range, then turns to the east, and is cut along the central line, or axis, gradually crossing it to the south. Keeping this direction for more than fifty miles, it then turns abruptly to a southwest course, and goes diagonally through the southern slope of the range."

"May 30.—This morning we are ready to enter the mysterious cañon, and start with some anxiety. The old mountaineers tell us it cannot be run; the Indians say, 'Water heap catch 'em;' but all are eager for the trial, and off we go."

"Entering Flaming Gorge, we quickly run through it on a swift current, and emerge into a little park. Half a mile below, the river wheels sharply to the left, and we turn into another cañon cut into the mountain. We enter the narrow passage. On either side the walls rapidly increase in altitude. On the left are overhanging ledges and cliffs five hundred, a thousand, fifteen hundred feet high.

"On the right the rocks are broken and ragged, and the water fills the channel from cliff to cliff. Now the river turns abruptly around a point to the right, and the waters plunge swiftly down among great rocks; and here we have our first experience with cañon rapids. I stand up on the deck of my boat to seek a way among the wave-beaten rocks. All untried as we are with such waters, the moments are filled with intense anxiety. Soon our boats reach the swift current; a stroke or two, now on this side, now on that, and we thread the narrow passage with exhilarating velocity, mounting the high waves, whose foaming crests dash over us, and plunging into the troughs, until we reach the quiet water below; and then comes a feeling of great relief. Our first rapid run. Another mile and we come into the valley again.

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"Let me explain this cañon. Where the river turns to the left above, it takes a course directly into the mountain, penetrating to its very heart, then wheels back upon itself, and runs into the valley from which it started, only half a mile below the point at which it entered; so the cañon is in the form of an elongated **U**, with the apex in the center of the mountain. We name it Horseshoe Cañon.

"Last spring, I had a conversation with an old Indian named Pa-ri-ats, who told me about one of his tribe attempting to run this cañon. 'The rocks,' he said, holding his hands above his head, his arms vertical, looking between them to the heavens—'the rocks h-e-a-p, h-e-a-p high; the water go h-oo-woogh, h-oo-woogh! water-pony (boat) h-e-a-p buck; water catch 'em; no see 'em Injun any more! no see 'em squaw any more! no see 'em pappoose any more!'

"June 7.—On a rock we find a pool of clear, cold water, caught from yesterday evening's shower. After a good drink we walk to the brink of the cañon, and look down to the water below. I can do this now, but it has taken several years of mountain climbing to cool my nerves, so that I can sit, with my feet over the edge, and calmly look down a precipice two thousand feet. And yet I cannot look on and see another do the same. I must either bid him come away or turn my head.

"This evening, as I write, the sun is going down, and the shadows are settling in the cañon. The vermilion gleams and roseate hues, blending with the green and gray tints, are slowly changing to somber brown above, and black shadows are creeping over them below; and now it is a dark portal to a region of gloom—the gateway through which we are to enter on our voyage of exploration to-morrow."

The 9th of June brought disaster to a boat containing three of the men, who were carried down the rapids, but all were rescued.

They pass the mouths of the Uintah and the White Rivers, with constantly changing scenes, making a tortuous journey through many dangerous rapids, much of the time between high, perpendicular walls.

On the 15th they pass around a great bend, five miles in length, and come back to a point one-quarter of a mile from where they started. Then they sweep around another great bend to the left, making a circuit of nine miles, and come back to one-third of a mile from where the bend started. The figure 8 properly describes the fourteen miles' journey. July 17 they arrive at the junction of the Grand and Green rivers, having traversed about eight hundred and four miles.

On the morning of July 19, the Major and a companion start to climb the left wall below the junction of the Grand and Green Rivers. They reach the summit of the rocks. The view is thus described: "And what a world of grandeur is spread before us! Below, us is the cañon, through which the Colorado runs. We can trace its course for miles, as at points we catch glimpses of the river. From the northwest comes the Green, in a narrow, winding gorge. From the northeast comes the Grand, through a cañon that seems bottomless, from where we stand. Away to the west are lines of cliff and ledges of rock—not such ledges as you may have seen, where the quarry-man splits his blocks, but ledges from which the gods might quarry mountains, that, rolled on the plain below, would stand a lofty range; and not such cliffs as you may have seen, where the swallow builds his nest, but cliffs where the soaring eagle is lost to view ere he reaches the summit. Between us and the distant cliffs are the strangely carved and pinnacled rocks of the *Toom pin wu-near Tu-weap*. On the summit of the opposite wall of the cañon are rock forms that we do not understand. Away to the east a group of eruptive mountains are seen—the Sierra La Sal. Their slopes are covered with pines, and deep gulches are flanked with great crags, and snow fields are seen near the summits. So the mountains are in uniform—green, gray, and silver. Wherever we look there is but a wilderness of rocks; deep gorges, where the rivers are lost below cliffs and towers and pinnacles; and ten thousand strangely carved forms in every direction, and beyond them mountains blending with the clouds." [Pg 109]

"Traveling as fast as I can run, I soon reach the foot of the stream, for the rain did not reach the lower end of the cañon, and the water is running down a bed of dry sand; and, although it comes in waves several feet high and fifteen or twenty feet in width, the sands soak it up, and it is lost. But wave follows wave, and rolls along, and is swallowed up; and still the floods come on from above. I find that I can travel faster than the stream; so I hasten to camp and tell the men there is a river coming down the cañon."

The exploring party next passes through Narrow Cañon, nine and a half miles long, Glen Cañon, one hundred and forty-nine miles in length; and Marble Cañon, sixty-five and one-half miles long. The depth of the last named is three thousand five hundred feet at the lower end. They emerge from Marble Cañon August 10, and find themselves separated from the Grand Cañon of the Colorado, the "Great Unknown," by the narrow valley of the Little Colorado.

The Grand Cañon is now entered and safely passed, a distance of two hundred and seventeen and one-half miles, terminating with the Grand Wash.

We are compelled to terminate this article abruptly for lack of space. It is proper to say that this journey has scarcely ever been equaled for daring and hardihood. Each time they descended a rapids, they were liable to come to a fall too great to shoot over, with walls so steep they could not be climbed, and rapids so swift as to prevent return.

The Grand Cañon, as one of the wonders of the world, is visited every summer by hundreds of tourists.

OPTIMUS.

BY REV. CHARLES COKE WOODS.

A glow-worm in the grass at night shed forth
Its feeble light, but darkness deepened fast;
The wee thing did its uttermost to banish night,
And that, forsooth, was truest toil, indeed,
Success in God's clear sight, though in man's view,
Obscured by things of sense, 'twas but defeat.

A fire-fly flashed its fitful light, while soft
The evening shadows fell, and clouds hid stars,
And veiled in black the gentle moon's bright face;
As if the night, like one afraid, would haste
To flee when lightning flashed from those small wings,
With courage high the insect gave its light,
Though all alone with none to proffer aid—
Nor sun, nor moon, nor star a single beam.

At last the dawn shot crimson up the sky;
The tiny toilers crawled away to rest,
And sweet, methinks, was their well-earned repose,
For each its place had filled, its task had done
In keeping with the great Creator's thought.

HOW THE EARTH WAS FORMED.

T. C. CHAMBERLIN,
Head Professor of Geology, University of Chicago.

JUST how the earth was formed at the outset is not certainly known. The most common view of men of science is that it was once in the form of a fiery gas. It is supposed that all the planets and satellites that now revolve around the sun were once a part of a common mass of gas in the form of a vast sphere which was very large and very hot. This gradually lost its heat and shrank as most bodies do when they cool. If it was not already whirling round at the outset it must have come to do so as it shrank, and as more and more of its heat was lost it rotated more and more rapidly. At length it came to whirl so fast that the outer part, which was moving fastest, could no longer be held down to the surface, and so it separated in the form of a ring around the equator of the great sphere.

The main mass kept on cooling and shrinking and whirling faster and faster and hence other rings separated. Each of these rings also kept on cooling and shrinking and is supposed to have parted at some point and gradually gathered together into a globe, but still in the form of fiery gas, even though it had lost much of its heat. But at last this globe of gas cooled so much that the main part of it became liquid. This was that part which afterwards became the solid part of the earth. It then had the form of lava. It was still too hot for the water to condense and hence it remained in the form of steam or vapor, forming a vast envelope all about the earth. There are supposed to have been many other vapors in the air at that stage, and it must have been very dense. But at length the globe of lava cooled so that the outer part crusted over, and this crust grew thicker and thicker as time went on. After a while it became cool enough to permit the water to condense on the surface and so the ocean began to be formed. The water grew in depth until nearly all the steam was condensed and many of the other vapors that had been in the air while it was so hot were condensed also. And this left the gases which cannot easily be condensed behind, and they formed the air much as it is to-day. And that is the way the atmosphere is commonly supposed to have come about.

But all this is theory. It cannot now be proved. But there are several great facts that fit in with it and make it seem as though it might be true. As wells and mines are sunk deep in the ground it is found that the earth grows warmer and warmer. Volcanoes pour out molten rock and this shows that it is very hot somewhere beneath them. Many of the mountains on the earth are really wrinkles in its crust, and it has been thought that these are caused by the cooling and shrinking of the globe. It is because these and other things fit in so well with the theory that most scientific men have come to accept it as probably true. It is known as the Nebular theory. But there are other ways of explaining all these things, and perhaps it may be proven that there are better ways.

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Photograph by F. J. Haynes, St. Paul..

TERRACED ROCKS,
YELLOWSTONE PARK.

CHICAGO,
A. W. MUMFORD,
PUBLISHER.

Some scientists have supposed that the earth was formed by small masses or particles of matter gathered in from the heavens. On a clear night shooting stars may be seen quite often. These are little bits of stone or metallic matter shooting through space at high rates of speed, which strike the atmosphere and become hot. The earth also is moving at great speed—nearly nineteen miles per second. It is not strange then that when the little stranger collides with the earth it should "make the fire fly." Usually the outside is melted and carried away so fast that the little mass is entirely used up in a few seconds. It merely makes a little streak of light. But sometimes the mass [Pg 113] is large enough to stand the waste and still reach the ground. In such cases it is found to be mainly stony matter and iron. No substance has ever been found in any of them which is not found in the earth. Only a few of these shooting stars or meteorites will be seen in looking at any one point in the heavens. But the earth is very large and there are many such points, and when these are taken all together it is found that the number of these little bodies which fall in a day is very large. It is estimated at twenty millions. But still they are small and do not add very much to the size of the earth. But as they are being constantly swept up from space and are growing fewer and fewer, and as this has been going on for a very long time, it is reasonable to suppose they may once have been much more abundant and that the earth then grew much faster by

reason of them. It is thought by some that the earth may have grown up entirely by gathering them in, the idea being that it was itself once only a little meteorite that succeeded in gathering the others in. It is commonly supposed, however, by those who hold to this view, that the earth was formed from some special cluster of these meteorites that gathered together. It has been thought that perhaps the gas of the rings mentioned before may have cooled down into little solid particles before they were collected together and that they built up the earth. This brings the two theories together in a measure. The planet Saturn, you know, has rings of this kind and they are made up of small solid bodies, and not of gas or liquid, as was once supposed.

If the earth was built up this way we must account for the heat in the interior, but this would come naturally enough. As the little bodies fell upon the surface they would strike hot. But unless they came fast they would cool off before others struck the same spot and the earth would not get very hot. But as they gradually built up the surface the matter below would be pressed together harder and harder because of the growing weight upon it, and this pressing together would make it hot. It is figured out that it would become very, very hot indeed, though this might not seem so at first thought, and that the volcanoes and mountains may all be explained in this way quite as well, and perhaps better, than in the other way. This is called the Accretion theory.

It may be that neither of these theories is right, and we will do well to hold them only as possible ways in which the earth may have been formed at the beginning. But, at any rate, the earth has been shaped over on the surface. In a certain sense its outer part has been remade. And this concerns us more than the question of its far-off origin, because our soils, ores, marbles, and precious stones, as well as our lands and seas, are all due to this reshaping. In the deepest parts of the earth which we can get at for study, we find that it is made up of rocks of the granite class; not always granite proper, but rocks like it. What is below this in the great heart of the earth we do not know, except that it is very dense and heavy. Rocks of the granite class are formed under great heat and pressure, or by the cooling of molten rock material. They may be called the basement rock or great floor, on which all the other rocks near the surface are laid. They underlie all the surface, but at different depths. In some places they have been crowded up by the pressure that came from the shrinking of the earth, of which we spoke before, and so have come to be actually at the surface, except that soil, clay, sand, or gravel may cover them. Under about one-fifth of the land these rocks lie just below the clays, gravels, sands, and soils that occupy the immediate surface. Sometimes they come out to the actual surface, and may be seen in ledges or bluffs. But usually the soils, sands, gravels, and clays cover them up more or less deeply, but even then they are often struck in sinking wells.

Under the other four-fifths of the land they lie much deeper, often several thousands of feet, and there are spread over them sandstones, shales, and limestones. These are the rocks we usually see in the quarries and cliffs of the interior states. The materials to form these were taken from the older rocks of the granite class by a process which is now going on—so we know how it is done. This is the way in which it takes place: The air and the rains and the water in the ground act upon the rocks, and cause them to soften and fall to pieces, forming soils, or sand, or little rock fragments. This material is gradually washed away by rains and floods. This does not usually quite keep pace with the softening; so the surface is covered with soil and other loose material. But it is little by little washed away, and carried down to sea, where it settles on the bottom, and forms layers of mud or of sand. The mud afterwards hardens, and becomes a kind of rock known as shale. The sands become cemented by lime or iron, or some other substance, and form a sandstone. The lime in the rocks that softened and decayed is chiefly dissolved out by the carbonic acid in the waters of the ground, and is carried away to the sea in solution. This lime is then taken up by sea animals to form their shells, skeletons, teeth, and other hard parts. Afterwards the animals die, and these hard, limy parts usually crumble more or less and form a bed of lime material, and later this hardens into limestone.

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Some of the lime is also separated from the waters by evaporation or by other changes. You have noticed that on the inside of a tea kettle there gathers a stony crust. This is made of the same material as limestone—indeed, it is limestone. It was dissolved in the water put in the tea kettle, but as the water was heated and partly changed into steam it could no longer hold all the lime, and some or all of it had to be deposited. So, in a similar way, sea-water is dried up by the sun and air, and deposits lime, and so beds of limestone are formed. You will readily see from what has been said why shales, sandstones, and limestones take the form of beds lying upon each other.

Now, away back towards the beginning, when the ocean was first formed, and some part of the earth was pushed up so as to form land, this process began, and has been at work ever since. The surface of the land has been moistened by the air and moisture, and then has been washed away to the ocean and laid down in beds. When these grew thick, and were pressed by the weight of the newer beds that were laid down on them, they hardened into rock again. And this has gone on for a very, very long time, and the beds of sandstone, shale, and limestone so formed have come to be many thousand feet thick in some places. The land would all have been worn away down to the level of the sea if the earth had not kept shrinking and wrinkling, or pushing up in places.

At different times portions of what was once the ocean bottom have been lifted and have become land. If these beds are examined they will be found to contain shells and corals and other sea animals which were buried in them when they were forming, and thus it is known that they were laid down under the sea. It is found also that the lower beds contain kinds of life different from those above, and the lower beds were, of course, formed first. So, by studying the sea-shells and

other relics in the beds, from the lowest ones up to the highest ones in the order in which they were formed, the various kinds of life that have lived in the sea from the beginning are found out. The life at the beginning was simpler than it is now, and quite different in many respects. There were gradual changes from time to time, and many strange creatures appeared that do not live at present.

RETURNING HOME.

GUY STEALEY.

I HAVE often wondered whether birds, like persons, do not grow to love some one locality better than all others, and if they do not return there year after year to make it their home. My belief is that they do. I have observed many cases that tend to confirm my views, and give a couple of them below.

One spring, six years ago, while my grandmother and I were out milking in the corral one evening, a pair of killdeer flew over our heads and, after circling around a few times, settled near us. We noticed then that the male had only one leg, the other being broken off near the knee. They skipped around in the way they have, stopping now and then to pick up a worm. All that summer they came nearly every night to catch the bugs and worms, which they often carried to the little fledglings in their nest by the lake.

Well, time passed on. Autumn came and went, and with it the killdeer and their young. The long winter wore away; then, on a bright spring morning, in precisely the same manner as before, our two friends, the killdeer, darted down in the corral again and went to feeding. The old fellow hopped about on his one leg as of yore, and seemed glad to see us again.

The next year it was the same way. They arrived at about the same time as on the two previous seasons, and hatched out their young as usual, down by the lake. They were quite tame by this time, and we began to regard them as pets.

The next spring, however, they failed to come, and you may be sure that we missed their clear, cheerful cries. We could not, of course, tell the cause of their non-appearance. One or both of them may have been killed or they may have died, as birds are liable to the same fate as we are; but one thing is certain, this pair came back here for three seasons.

Another summer, while passing near the river, a humming bird flew out of the bushes almost under my feet, and from its actions I felt certain it had a nest there. And sure enough, on stooping down and parting the leaves I found her nest, built on a single rose stem, projecting over the water. Two tiny birds reposed on their soft bed. Below this nest, on the same stem, and but a few inches apart, were two old ones. They were somewhat ragged, as was natural, from the war of the elements that had raged during one and two years. So, these humming birds must have made this their home for several summers.

THE PLANT PRODUCTS OF THE PHILIPPINE ISLANDS.

THE Department of Agriculture has recently issued a report on the plant products of the Philippine Islands, which is particularly interesting at the present time. The report deals with the agricultural resources of the islands as they now exist, and shows that although an agricultural country, the islands do not produce enough food for the consumption of the inhabitants. In order to supply the deficiency, it is the custom to draw upon rice-producing countries, such as Cochin China. About one-ninth of the area of the Philippine Islands, or 8,000,000 acres, is devoted to agriculture. When the natural fertility of the soil is considered and the large amount of rich land not yet cultivated, it can be assumed that with better agricultural methods the products of the islands could be increased tenfold. Rice forms one of the most important food products of the islands; more than a hundred varieties are grown; the annual production is about 36,000,000 bushels. This is, of course, far below the actual requirements of [Pg 116] the population, even when supplemented by other vegetables and fruits. Maize, next to rice, is one of the most important of the grain products of the Philippines, and the sweet potato follows maize in turn. Fruits grow in great abundance, bananas heading the list. Large quantities of sugar cane are grown, but owing to crude methods of manufacture, the sugar is inferior in quality and is sold for a low price. Cotton is not as valuable a product for the islands as it once was, owing to the successful competition of British fabrics. Formerly indigo also was one of the important products of the islands. Coffee plantations thrive well, but the coffee is not of the best quality and the plantations are not well managed. In most of the islands of the archipelago tobacco is grown and over one hundred million cigars are annually exported from Manila. The shipment of leaf tobacco averages about 20,400,000 pounds. The islands also furnish spices and medicinal plants are abundant, but most of them are little known.

HONEY BIRDS.

THERE are in Africa, Australia, and in South America certain birds, evidently not related ornithologically, that, because of their peculiar habits, are known as "honey birds," the special traits of which afford an interesting study in animal reasoning or instinct, as one may choose.

One of these, the species common to a large area in Central and South Africa, mentioned by many travelers, has been briefly described by that prince of realists, Dr. James Johnston of Brownstown, Jamaica, in his superb work, "Reality vs. Romance in South Central Africa," on page 106. He says: "Our daily meeting with the honey birds served to remove any skepticism I may have had in reference to this cunning little creature. It is not much larger than a canary, and as soon as man makes his appearance hops from branch to branch, making repeated flights toward the traveler and then flying off in the direction in which it appears to wish attention attracted, with a sustained *chic-en, chic-en, chic-chur, chur*, returning again and again, until its opportunity is awarded by someone accepting its invitation to follow to the spot where is stored the—to it—inaccessible treasure. It makes a great fuss, flying round and round and round, leaving no doubt as to the whereabouts of its find. Sometimes there is no opening to be seen; when the native proceeds to tap upon the trunk with the head of his hatchet until he locates the hive. He then obtains the honey by making a fire at the root of the tree, and, under cover of the smoke, with his hatchet secures the prize. Then is revealed the reason for the excitement of our tiny guide, who now comes in for its share of the pickings."

Several explorers whose good fortunes have taken them well into the interior of the Australian bush have described the somewhat similar actions of a species of bird spoken of as being "nearly as large as a crow" and evidently quite distinct from the African species. In Haiti I have had opportunities of observing the like performances of a bird, shy and elusive for the most part and only at all approachable when the presence of honey renders it bold, which appeared to be closely related to our northern cedar bird. And, if an eye not specially trained in ornithology be not at fault, the same species is to be observed on the mainland, along the middle reaches of the Orinoco, in Venezuela.

October turned my maple's leaves to gold;
  The most are gone now; here and there one lingers;
Soon these will slip from out the twig's weak hold,
  Like coins between a dying miser's fingers.
—*T. B. Aldrich.*

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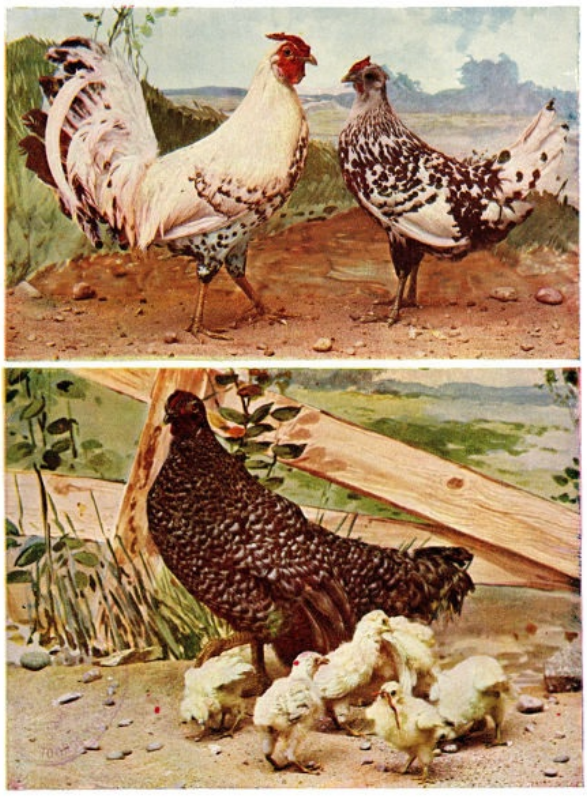

276 ROOSTER AND HEN. CHICAGO, A. W. MUMFORD, PUBLISHER.

FARM-YARD FOWLS.

Silver-Spangled Hamburg.—These fowls are among the most highly developed of all the spangled varieties. They are valued as egg producers and rank among the best. They are very impatient of confinement and are said to succeed best when they can have the run of a clean pasture or common. A large grass walk is recommended by the most successful breeders. Six-foot fences, where they are intended to be restricted to certain limits, will not be more than sufficient for the safe custody of these chickens. The hens, if young, lay nearly throughout the year, but the eggs, which are white, are small, weighing about 1½ ounces each. As they are such abundant layers they seldom want to sit. The chickens are healthy and strong requiring no unusual care. When first hatched they are cream-colored. They feather early and the barred character of the penciled birds quickly appears. In the rapidity of their movements they are said to rival even the active little Bantams.

It has been observed that both sexes of all the varieties continue to improve in appearance after each moult until they are 3 years old. Birds of 1 year old have never attained to their full beauty, this being especially apparent in the more ample development of the tail-feathers of the cock as he becomes older. At from five to six months old they are fit for table use, their meat white, tender, and well-flavored.

The Silver-Spangled Hamburg, or Silver Pheasant, as it is commonly called there, is a breed that has for generations been known in England. In Lancashire this variety had been brought to a very high standard of excellence years before poultry shows were thought of, and, as Wright observes, all our modern skill and careful breeding have been unable to improve upon the old breed of Mooneys, as they were called, which were absolutely perfect in point of feather. The spangling, so large, round, and rich in color, was really something to be wondered at and shows a skill and enthusiasm in breeding which has about it something of the marvelous.

Plymouth Rock Hen and Chickens.—In March, 1873, Rev. H. H. Ramsdell thus describes the origin of this valued fowl:

"Some thirty years since John Giles, Esq., introduced a fowl into this vicinity—Putnam, Conn.—called the Black Java. Its plumage was black and glossy, its size large, pullets sometimes reaching 11 pounds in weight. It was an unusually hardy bird, with a dark, slate-colored, smooth leg and the bottom of the feet yellow. The hens proved good layers and of extra quality for the table. I sold a few of these birds to a Mr. Thayer of Pomfret, of whom Mr. George Clark of Woodstock, Conn., purchased some he supposed the same. Mr. Clark, passing Mr. Joseph Spaulding's yard one day, noticed his fine flock of Dominiques and proposed bringing a few of his Javas over to cross with them to increase the size. Mr. Spaulding accepted the offer, and when the chickens were grown rejected the black ones and those with double comb, reserving to breed from only the single-comb birds, which retained the Dominique color, or near it. One of the first products from the eggs of this cross was a hen which weighed 9¾ pounds. We soon had a fine flock of them. The fowls were spread around the neighborhood and were much sought after, but had as yet no name. A gentleman asked me what I called them. I said 'Plymouth Rock.' The name passed from one to another and they were soon generally known by that name."

The general characteristics of the cock are: Comb single, upright, and neatly arched, notched, or serrated; body large and deep; back broad and short; breast deep, broad, and full; thighs large and strong; size very large, ranging from nine to twelve pounds; general shape massive, but compact; carriage upright and commanding.

THE GRAND CAÑON OF THE COLORADO RIVER IN ARIZONA.

PRIN. WM. I. MARSHALL,
Lawndale School.

THE Colorado River is pre-eminently "The River of Cañons." Formed in eastern Utah by the junction of the Green River, rising in northwest Wyoming, and the Grand, which has its sources in the mountain rim which walls in the Middle Park of the State of Colorado, not a mile of the Colorado River is in the state of Colorado.

About two-fifths of its nearly 2,000 miles, reckoning from the sources of the Green, which is the main stream, flows through cañons, the series culminating in magnitude and grandeur in the Grand Cañon of the Colorado in Arizona. In 1875, the Government Printing Office at Washington printed in a finely illustrated quarto volume of 291 pages, under the modest and unpretentious title of "Exploration of the Colorado River of the West and Its Tributaries, Explored in 1869, 1870, 1871, and 1872 Under the Direction of the Secretary of the Smithsonian Institution," the fascinating and graphic story of one of the most perilous explorations ever undertaken by man, and one whose origin and successful outcome were due to the scientific enthusiasm, the great endurance, the fertility of resources and the dauntless courage of Maj. J. W. Powell. Few men with two arms would have dared to enter upon, or could successfully have completed the task, and he had left his good right arm on a battle-field of our civil war.

In 1882, the United States Geological Survey, of which Maj. Powell was then director, printed Vol. II of its Monographs, being the "Tertiary History of the Grand Cañon District, by Capt. C. E. Dutton, U.S.A.," a sumptuous quarto of 264 pages, with maps and splendid illustrations.

These two books are, and must ever remain the great authorities on "The River of Cañons," and I shall only write briefly of the route to and scenic splendors of the Grand Cañon.

It is accessible from various points along the Santa Fe Railway, but most easily at present by a stage ride of seventy-three miles, at an elevation above the sea varying from 6,866 to nearly 9,000 feet, from Flagstaff, Arizona—a beautifully situated mountain town at the southern base of the San Francisco Peaks, a cluster of volcanic mountains, the loftiest of which rises nearly 13,000 feet above the sea, and some 6,000 feet above Flagstaff.

At Flagstaff is the famous Lowell Astronomical Observatory, and about it are many points of much interest, especially Walnut Creek Cañon, with its extensive ruins of the cliff dwellers' houses built midway up the face of the almost vertical cliffs.

The first and last thirds of the stage ride to the Cañon are through the great Conconino Forest of long leaved pines—much scattered and with no underbrush—but commonly with splendid grass and unnumbered wild flowers covering all the open spaces between them.

The middle third is over a more desert region, but not destitute of grass, and with stunted pines and cedars growing on most of the ridges and hills along the way.

For the past two years there has been little rain and the route last July was much more dusty than when I went over it first in 1895, and deemed it one of the most enjoyable stage rides I had ever taken; but rains late in July made it much pleasanter when I returned in August, this year, for a third visit.

Along the whole seventy-three miles there is no lake, pond, river, creek, brook, rivulet, or rill, no running water except springs at two points many miles apart which have been piped into troughs for stock.

This absence of water over so wide an expanse seems at first wholly incompatible with the splendid forests of stately pines, with some aspens and scrubby oaks interspersed, and the luxuriant grass and innumerable flowers. [Pg 121]

They are kept alive by the moisture of the heavy snows of winter, and the coolness of the nights in the warmer months, checking the evaporation, and by occasional rains in summer, mostly in July and August.

We are promised a branch railroad in the near future from the main line of the Santa Fe to the Cañon.

All previous observations of cañons fail utterly to give any adequate ideas of the immensity and the splendor of this, "the sublimest spectacle on earth." No narrow crack in the earth's crust is this cañon, but a vast chasm 217 miles long, from five to twelve miles wide and from 5,000 to 6,000 feet deep, with a great river rolling tumultuously along its bottom, miles away from us as the crow flies, and nearly a mile below us vertically.

As there are very few places where it is possible to climb down to the river, one might perish from thirst while wandering along the brink of this cañon, and having in plain view at many points one of the greatest rivers of the west coast of America.

It is the only cañon on earth vast enough to have scores of mountains within it.

It is a double cañon, *i. e.* a cañon within a cañon.

The outer cañon is from 2,000 to 3,000 feet deep, and from five to twelve miles wide.

Its general direction is east and west, but the mighty river, which in ancient geologic ages eroded this vast abyss, curved, like all rivers, now this way and now that, so that each wall is recessed in mighty amphitheaters, between which comparatively narrow promontories or points run out from one to six miles into the cañon.

From the base of the mighty palisade which forms the walls of the outer cañon stretches a plateau 5, 8, 10, or 12 miles wide, to the equally lofty palisade which forms the opposite wall of the outer cañon, and somewhere near the middle of this plateau is sunk the inner cañon, another 2,000 to 3,000 feet deep, with a width at the top varying from one-half to three-fourths of a mile, and in its somber depths rolls the ever turbid Colorado, ceaselessly at its endless labor of cutting down the mountains and sweeping their ruins to the sea.

Scattered all over this plateau are the remains of what were once long promontories like the points on which we now walk or ride far out towards the middle of the cañon, but which have weathered so that they are now lines of hills and mountains.

Real mountains many of them are, for from their bases on the plateau, 2,000 to 3,000 feet above the bottom of the inner cañon, they rise 1,500 to 2,500 feet, nearly or quite to the level of the tops of the cliffs bounding the outer cañon.

Nearly all the length of the cañon is through sandstones, and limestones, and shales, resplendent with the colors which add so much to the beauty of Rocky Mountain scenery.

The almost uniform horizontality of stratification of these rocks demonstrates that the erosion of the cañon was little aided or affected by any violent upheavals or disturbances of the rocks.

We see clearly about twenty-five miles each way along the cañon, and somewhat indistinctly probably another twenty-five or thirty miles each way, and everywhere is the same indescribable splendor of color and of beauty of form.

It is a new "Holy City," and whether viewed from above, by a ride or walk along the edge of the cañon, or from the multitudinous turns and loops of the trail by which one can descend on horseback to the plateau and ride across to the edge of the inner cañon, whence a path enables us to safely climb on foot down to the river's edge, everywhere we seem to be gazing on the ruins of cities, palaces, towers, and temples, such as might have been builded by the gnomes and genii of the "Arabian Nights."

Speaking of these weather-sculptured buttes or mountains of bare and splendidly colored rock which stand within the outer cañon, Dutton says:

"Some of these are gorgeous pagodas, sculptured in the usual fashion, and ending in sharp finials at the summit. Others are the cloister buttes with wing-walls and gables, panels and alcoves. All are quarried out upon a superlative scale of magnitude, and every one of them is a marvel. The great number and intricacy of these objects confuse the senses and do not permit the eye to rest. The mind wanders incessantly from one to another and cannot master the multitude of things crowded at once upon its attention. There are scores of these structures, any one of which, if it could be placed by itself upon some distant plain, would be regarded as one of the great wonders of the world," and of the colors he says: [Pg 122]

"The color-effects are rich and wonderful. They are due to the inherent colors of the rocks, modified by the atmosphere. Like any other great series of strata in the Plateau Province, the carboniferous has its own range of characteristic colors, which might serve to distinguish it even if we had no other criterion. The summit strata are pale-gray, with a faint yellowish cast. Beneath them the cross-bedded sandstone appears, showing a mottled surface of pale-pinkish hue. Underneath this member are nearly 1,000 feet of the Lower Aubrey sandstones, displaying an intensely brilliant red, which is somewhat masked by the talus shot down from the gray, cherty limestones at the summit. Beneath the Lower Aubrey is the face of the Red Wall limestone, from 2,000 to 3,000 feet high. It has a strong red tone, but a very peculiar one. Most of the red strata of the west have the brownish or vermilion tones, but these are rather purplish-red, as if the pigment had been treated to a dash of blue. It is not quite certain that this may not arise in part from the intervention of the blue haze, and probably it is rendered more conspicuous by this cause; but, on the whole, the purplish cast seems to be inherent. This is the dominant color-mass of the cañon, for the expanse of rock surface displayed is more than half in the Red Wall group. It is less brilliant than the fiery-red of the Aubrey sandstones, but is still quite strong and rich. Beneath are the deep-browns of the lower carboniferous.

"The dark iron-black of the horn-blendic schists revealed in the lower gorge makes but little impression upon the boundless expanse of bright colors above."

217 OIL WELL. CHICAGO, A. W. MUMFORD, PUBLISHER.

OIL WELLS.

OIL IS found in Pennsylvania in oil-bearing sand-rocks, which are considered as the reservoirs in which the distilled product has found a permanent lodgment. The depth of the oil-sand or sand-rock in this state is from 800 to 1,900 feet. There are often several strata, one above the other, containing oil.

It is the uniform experience that the lightest oils are found in the lowest sandstones, while the heaviest oils are drawn from the shallowest wells; and as we approach the surface where it is gathered from the pools dug to the depth of only a few feet, it becomes sticky, semi-fluid, and finally a solid asphalt.

Man made no attempt to bore a deep hole through soil and rock, hundreds of feet down, to reach oil, until the summer of 1859. The first oil company was formed in 1854, with Mr. George H. Bissell at its head, which bored the first oil well in the summer of 1859 under the direction of E. L. Drake. It was about the middle of June that "Uncle Billy Smith" and his two sons arrived in Titusville, on Oil Creek, Pa., the scene of operations.

"The pipe was successfully driven to the rock, thirty-six feet, and about the middle of August the drill was started. The drillers averaged about three feet a day, making slight 'indications' all the way down. Saturday afternoon, August 28, 1859, as Mr. Smith and his boys were about to quit for [Pg 125] the day, the drill dropped into one of those crevices, common alike in oil and salt borings, a distance of about six inches, making a total depth of the whole well sixty-nine and one-half feet. They withdrew the tools, and all went home till Monday morning. On Sunday afternoon, however, 'Uncle Billy' went down to reconnoiter, and peering in he could see a fluid within eight or ten feet of the surface. He plugged one end of a bit of rain-water spout and let it down with a string, and drew it up filled with petroleum.

"That night the news reached the village, and Drake when he came down next morning bright and early found the old man and his boys proudly guarding the spot, with several barrels of petroleum standing about. The pump was at once adjusted, and the well commenced producing at the rate of about twenty-five barrels a day. The news spread like a prairie fire, and the village was wild with excitement. The country people round about came pouring in to see the wonderful well. Mr. Watson jumped on a horse and hurried straightway to secure a lease of the spring on the McClintock farm, near the mouth of the creek. Mr. Bissell, who had made arrangements to be informed of the result by telegraph, bought up all the Pennsylvania oil-stock it was possible to get hold of, and four days afterwards was at the well."

This memorable strike ushered in the petroleum era. It now only remained to develop this "bonanza." The condition of things on Oil Creek in 1865 is given as follows: "The surface of the whole country was saturated with oil from the leaking barrels, the overflow and enormous wastage from the wells before they could be got under control, and from the leakage and bursting of tanks. The peculiar odor of petroleum pervaded everything; the air for miles was fairly saturated with it; nothing else was thought of; nothing else was talked about. Land was sold at thousands of dollars per acre. Fortunes were made and lost in a day. Oil companies with high-sounding names were organized almost without number, absorbing millions of money; many companies were formed without the shadow of a basis for operations, and many persons who were as covetous as they were ignorant, were drawn into the maelstrom of speculative excitement and hopelessly ruined. No parallel in the history of speculation in this country can be found, excepting, perhaps, that which occurred during the 'California gold fever' of 1849."

The Pennsylvania oil region and the Russian oil region are the two greatest centers of petroleum in the world. The latter has its center at Baku, on the Caspian Sea. The following interesting state of affairs at Baku in 1872 is given by Major Marsh:

"The afternoon was devoted to the great natural wonders of Baku, petroleum and the everlasting fires. At Surakhani the whole country is saturated with petroleum; on making a hole in the ground the gas escapes, on lighting which it burns for a very long while, one of the few spots on earth where this phenomenon can be seen. When there is no wind the flame is dull and small, but in a gale it roars and leaps up eight or ten feet. There are two naphtha refining establishments at Surakhani, the furnaces of which are entirely heated by the natural gas, which is collected as it rises out of the ground in an iron tank and led off by pipes. At night the whole place is lighted in the same manner, by ordinary gas burners attached to the walls. On returning home in the evening we saw the silent waste, lit up by various fires, each surrounded by a group of wild Tartars cooking their food by its heat.

"We shall have occasion further on to furnish more particular information respecting the enormous yield of the wells around Baku, and therefore in this connection only incidentally allude to the statement of the geographer, who notices the 'seven hundred oil wells' which have all been drilled, none of which shows any signs of exhaustion, and says that 'immense loss is caused by the ignorance of those engaged in the trade. Thus a well at Balakhani, yielding 36,571 barrels of [Pg 126] naphtha daily, ran waste for four weeks before reservoirs could be prepared to receive the oil.'"

A celebrated Russian scientist, after a visit to Baku in 1882, said: "Comparing results achieved in the two countries on one side and the average depth and total number of wells on the other, it may justly be stated that the natural petroleum wells of Baku, as far as our knowledge goes, have no parallel in the world."

The statement concerning the enormous yield from some of the wells of this district may well challenge our credulity. The following graphic description of the bursting forth of the great Droojba fountain is from an eyewitness and is given in the words of Mr. Charles Marvin: "In America there are over 25,000 petroleum wells; Baku possesses 400, but a single one of these 400 wells has thrown up as much oil in a day as nearly the whole of the 25,000 in America put together. This is very wonderful, but a more striking fact is that the copiousness of the well should have ruined its owners and broken the heart of the engineer who bored it after having yielded enough oil in four months to have realized in America at least one million sterling. In Pennsylvania that fountain would have made its owner's fortune. There is $50,000 worth of oil flowing out of the well every day. Here it has made the owner a bankrupt (on account of the damage done by the oil to surrounding property). These words were addressed to me by an American petroleum engineer as I stood alongside of the well that had burst the previous morning and out of which the oil was flowing twice as high as the Great Geyser in Iceland with a roar that could be heard several miles round. The fountain was a splendid spectacle and it was the largest ever known at Baku. When the first outburst took place the oil had knocked off the roof and part of the sides of the derrick, but there was a beam left at the top, against which the oil broke with a roar in its upward course and which served in a measure to check its velocity. The derrick itself was 70 feet high and the oil and the sand, after bursting through the roof and sides, flowed three times higher, forming a grayish-black fountain, the column clearly defined on the southern side, but merging into a cloud of spray thirty yards broad on the other. The strong southerly wind enabled us to approach within a few yards of the crater on the former side and to look down into the sandy basin from around about the bottom of the derrick, where the oil was bubbling and seething round the stalk of the oil-shoot like a geyser. The diameter of the tube up which the oil was rushing was 10 inches. On issuing from this the fountain formed a clearly defined stem about 18 inches thick and shot up to the top of the derrick, where, in striking against the beam, which was already half-worn through by friction, it got broadened out a little. Thus continuing its course more than 200 feet high, it curled over and fell in a dense cloud to the ground on the northern side, on a sand bank, over which the olive-colored oil ran in innumerable channels toward the lakes of petroleum that had been formed on the surface of the estate. Now and again the sand flowing up with the oil would obstruct the pipe or a stone would clog the course; then the column would sink for a few seconds lower than 200 feet, but rise directly afterward with a burst and a roar to 300 feet.... Some idea of the mass of matter thrown up from the well could be formed by a glance at the damage done on the south side in twenty-four hours; a vast shoal of sand was formed, which buried to the roof some magazines and shops and blocked to the height of six or seven feet all the neighboring derricks within a distance of 50 yards.... Standing on the top of the sand shoal we could see where the oil, after flowing through a score of channels from the ooze, formed in the distance or lower ground a whole series of oil lakes, some broad enough and deep enough in which to row a boat. Beyond this the oil could be seen flowing away in a broad channel toward the sea. This celebrated well, from the best estimates that could be made, gushed forth its oil treasure at the rate of 2,000,000 gallons a day from a depth of 574 feet."

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About the year 1858 oil was discovered in Berksville, Tenn., on the Cumberland River. It was called rock oil and was hawked about the streets as a sure cure for rheumatism. About 1866 there was a company formed to develop the petroleum then so-called. The transportation from Berksville to market was so dear that the company was unsuccessful. At Glasgow, twelve miles from Cave City, Ky., near the Mammoth Cave, there was a well, and a transportation trough was suggested by Mr. Geo. Northrup, which was never used. But the suggestion finally led up to the subsequent use of pipe lines for transporting the oil. The first oil used was at the head-waters of the Cumberland River. It was sold in a crude state and was not then used for illuminating purposes. A few years afterwards, when it was discovered in Pennsylvania, it was so used, although still in a comparatively crude condition. The price of oil was then about thirty-five cents a gallon at retail, or to the consumer. It has since been sold to the consumer at as low a price as seven cents a gallon.

The Standard Oil Company owned the first pipe lines that transported oil from the Pennsylvania oil fields to the seacoast. It was then and still is the only company that has furnished the best oil product. The American oil is said to be at least twenty-five per cent. superior to the Russian article. It is of a higher grade and commands, naturally, a higher price.

It is assumed that there must still be great quantities of oil in the rock formation of the earth. The substance is absorbed by the rocks where deposited and does not evaporate, therefore it would long ago have disappeared by absorption were it not that there must be vast areas of it still lying ready to be pumped to the surface.

The odor of the petroleum first discovered was similar to that of the cheap bituminous coal. In this respect there has been a great improvement, although there is yet room for the removal of what, to many, is a very unpleasant odor.

In the fall of 1865 the narrator, Mr. George Northrup, at that time a young Chicago business man, still living in that city, believing that vast fortunes could be made in the oil regions, caught the fever, and ascertaining that new fields were being developed in Glasgow, Ky., went there with $5,000 capital, intending to invest it, fancying that amount would be sufficient to buy oil land and develop the same. Arriving at Cave City, on the L. & N. Railway, he was lucky enough to get a seat on the stage coach that ran to Glasgow. The only public inn was filled to overflowing, and he was obliged, with others, to sleep on the office floor of the hotel. Two miles before

reaching the town the odor from the wells in operation affected him to such a degree that he confesses that no bouquet of flowers ever seemed to him sweeter. After dining at the hotel he was approached by a score of speculators who inquired of him whether he desired to invest in oil territory, which was held at from $25,000 to $200,000 an acre. He said that he would investigate the next day, became disgusted and immediately disappeared. The principal objection to the territory was the absolute absence of transportation. It was then that he suggested the use of a trough for the transportation of the oil to Glasgow, a distance of twelve miles, since which time it has been carried by pipe from the oil fields of Pennsylvania to the Atlantic Ocean.

THE BADGE OF CRUELTY.

CELIA THAXTER.

IS it not possible to persuade the women of Boston—the city we are proud to consider a centre of refinement, reason and intelligence—to take a decided stand in the matter of the slaughter of birds, and protect them by refusing to wear them? We are fostering a grievous wrong out of pure thoughtlessness. A bit of ribbon, or a bunch of flowers, or any of the endless variety of materials used by the milliner would answer every purpose of decoration, without involving the sacrifice of bright and beautiful lives. But women do not know what they are doing when they buy and wear birds and feathers, or they never would do it. How should people brought up in cities know anything of the sacred lives of birds? What woman, whose head is bristling with their feathers, knows, for instance, the hymn of the song-sparrows, the sweet jargon of the blackbirds, the fairy fluting of the oriole, the lonely, lovely wooing-call of the sandpiper, the cheerful challenge of the chickadee, the wild, clear whistle of the curfew, the twittering of the swallows as they go circling in long curves through summer air, filling earth and heaven with tones of pure gladness, each bird a marvel of grace, beauty, and joy? God gave us these exquisite creatures for delight and solace, and we suffer them to be slain by thousands for our "adornment." When I take note of the head-gear of my sex a kind of despair overwhelms me. I go mourning at heart in an endless funeral procession of slaughtered birds, many of whom are like dear friends to me. From infancy I have lived among them, have watched them with the most profound reverence and love, respected their rights, adored their beauty and their song, and I could no more injure a bird than I could hurt a child. No woman would if she knew it. The family life of most birds is a lesson to men and women. But how few people have had the privilege of watching that sweet life; of knowing how precious and sacred it is; how the little beings guard their nests with almost human wisdom and cherish their young with faithful, careful, self-sacrificing love! If women only knew these things there is not one in the length and breadth of the land, I am happy to believe, who would be cruel enough to encourage this massacre of the innocents by wearing any precious rifled plume of theirs upon her person.

Extract from Henry Ward Beecher's letter to Bonner on the death of the Auburn horse:

"Ought he not to have respect in death, especially as he has no chance hereafter? But are we so certain about that? Does not moral justice require that there should be some green pasture-land hereafter for good horses—say old family horses that have brought up a whole family of their master's children and never run away in their lives; doctors' horses that stand unhitched, hours, day and night, never gnawing the post or fence, while the work of intended humanity goes on; omnibus horses that are jerked and pulled, licked and kicked, ground up by inches on hard, sliding pavements, overloaded and abused; horses that died for their country on the field of battle, or wore out their constitutions in carrying noble generals through field and flood, without once flinching from the hardest duty; or *my* horse, old Charley, the first horse that I ever owned; of racing stock, large, raw-boned, too fiery for anybody's driving but my own, and as docile to my voice as my child was?"

CHICAGO,
A. W. MUMFORD,
PUBLISHER.

Hungarian Ash. White Walnut.

Cherry. Bird's-eye Maple.

Mahogany. Oak.

FINISHED WOODS.

Ash.—This name is applied to four species of forest trees. Most of the species are indigenous in North America, and some are found in Europe and Asia. The majority of these trees are large, affecting shady and moist places, banks of rivers, or marshes. The wood is tough and elastic, and is used by wheel-wrights, carriage-makers, and ship-builders. The Hungarian species is a favorite with cabinet-makers.

Cherry.—The common cherry tree (*Prunus cerasus*) is of Asiatic origin, and is said by Pliny to have been introduced into Italy by Lucullus about seventy years before Christ, and about 120 years after was introduced into Britain. It is extensively cultivated in the timber regions of Europe and America. There are now more than 300 varieties. The wood is of a reddish hue, hard and tough, and much used by the cabinet-maker; the gum is edible, and the fruit is eaten either fresh or dried, and is used for preserves. The cherry is best propagated by grafting with seedlings of the wild cherry.

Mahogany.—This wood is a native of South America, Honduras, and the West Indies Islands, and among the most valuable of tropical timber trees. It is a large, spreading tree, with pinnate, shining leaves. The trunk often exceeds fifty feet in height, and four to five feet in diameter. The flowers, three or four inches long, are small and greenish-yellow, and are succeeded by fruit of an oval form and the size of a turkey's egg. The wood is hard, heavy and close-grained, of a dark, rich brownish-red color, and susceptible of a high polish. The collection of mahogany for commerce is a most laborious business, often involving the construction of a road through a dense forest, upon which the wood may be transported to the nearest water-course. The natives make this wood serve many useful purposes, as canoes and handles for tools. The largest log ever cut in Honduras was seventeen feet long, fifty-seven inches broad, and sixty-four inches deep, measuring 5,421 feet of inch boards, and weighing upward of fifteen tons.

Mahogany is said to have been employed about the year 1595 in repairing some of Sir Walter Raleigh's ships, but it was not used for cabinet work until 1720, when a few planks from the West Indies were given to Dr. Gibbons of London. A man named Wollaston, employed to make some articles from this wood, discovered its rare qualities, and it was soon in high repute.

White Walnut.—Walnut (the nut of Jupiter) is the common name of large nut-bearing forest trees of the genus *Juglans*, which, with the hickories, make up the walnut family, in which the trees have a colorless juice, a strong scented bark, and compound leaves. Three species of the walnut are found in the United States. The wood is hard, fine-grained, and durable.

Bird's-eye Maple.—This is one of about fifty species, which are distributed over North America, Europe, Northern Asia, Java, and the Himalayas. While the wood of some of these is perfectly straight-grained, that in other specimens presents marked and often elegant varieties. The bird's-eye maple has its fibers so singularly contorted as to produce numerous little knots which look like the eye of a bird. It is a variety much valued for cabinet work of various kinds and interior finishing, while the straight-grained wood is used for making lasts, buckets, tubs, and other articles. It is also employed in ship-building.

Oak.—The English name of trees of the genus *Quercus*. Oaks are found over nearly the whole northern hemisphere, except the extreme north; in the tropics along the Andes, and in the Moluccas. All oaks are readily recognized by their peculiar fruit, consisting of an acorn with a cup which never completely encloses the nut. Some of the oaks furnish valuable timber. Tannic and gallic acids are obtained from them and the bark of many is useful for tanning. The nuts not only supply human food but that of various animals. The species vary so much that the genus is puzzling to botanists. The character of the wood is affected by the soil and locality in which the trees grow, lumbermen making distinctions not recognized by botanists. The white oak is long-lived, and specimens supposed to have been in existence before the settlement of the country are still standing. It is of slow growth, but does not cease to grow as it gets larger. The oak is much esteemed as an ornamental tree. The names of some of the varieties are: Post oak, burr oak, swamp oak, live oak, black oak, willow oak, scrub oak, scarlet oak, and California evergreen oak.

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THAT ROOSTER.

BY ELANORA KINSLEY MARBLE.

HE was a noble looking fowl, that rooster, and challenged my admiration by his unusual proportions, glossy plumage, and proud, exultant air.

As I paused in my walk to view him his sharp eyes were instantly fastened upon mine and a note of warning issued from his handsome throat. Away scampered the hens and young chicks, but the rooster, advancing a pace or two, lifted one foot menacingly, as if to defy my taking one step further.

"Dear, dear!" I exclaimed, "you make a great fuss over nothing. I only stopped to admire you and your family. Be assured I meant you no harm."

"*Gluck, gluck, gluck*," replied he angrily.

The spectacle of a champion standing on one leg and sending forth such a cry of defiance struck me as so ridiculous that I involuntarily burst into laughter.

Every fowl in the inclosure at the sound stood motionless.

"What was that?" questioned one motherly old hen of another.

It was a queer gibberish which she spoke, and most people would have failed to understand it, but to me—who had been listening to the voices of nature the whole day long, to whom the trees had whispered their secrets, the brooks had murmured their complaints, the birds had caroled their stories—to me the language of these feathered creatures was perfectly intelligible.

"I don't know, I'm sure," replied the other, "but somehow it sounded rather pleasant."

"Pleasant!" exclaimed a young white and buff hen, tossing her pretty head, "it appeared to me she was making fun of us."

"Will you be quiet, you cackling old hens?" roared Mr. Rooster, giving them a swift glance from one eye, while furtively watching me with the other. "What business is it of yours what the intentions of this intrusive person may be? I am the one to decide that question. What do females know about war, anyway, especially hens? If she means fight, why——"

"You'll run, no doubt, and hide behind your wives," I interrupted, feeling the old fellow to be a boaster. "I've a notion to scale the fence and see," I added mischievously.

He stepped back a pace or two in evident alarm.

"Never fear," I hastened to say. "Only cowardly hearts find pleasure in giving pain to innocent and defenseless creatures. My only object in stopping was to view your happy family and—and—in fact, Mr. Rooster, to interview yourself."

"Interview me?" he exclaimed. "Well, I never!" and filled with a sense of his importance the old fellow set up such a crowing that even a Jersey cow, munching grass by the wayside, paused to ruminate over what it might mean.

"A reporter," sneered the ill-natured young hen. "A woman reporter! How unnatural!"

"Louisa Mercedes," sharply cried the rooster, "how many times have I told you to bridle your tongue?"

"I'm not a horse," sulkily replied Louisa, "and what's more, I think if you would bridle your vanity it would be much more to your advantage. You want to do all the talking—and eating, too," she added in an undertone. [Pg 133]

"She's but a young thing," loftily said Mr. Rooster, "and I have to overlook much of her insolence, you know. Another year will find her less spirited, like Georgiana and Marthena and Sukey over there. But let us resume our conversation. About what do you want to interview me?"

"First, I should like to know—why, do you intend to come out?" I interrupted as he moved nearer the fence.

"Oh, no; but it's just as well that the women folks don't hear all we have to say. They have such a disagreeable fashion of contradicting, you know, and such good memories, that when you're least expecting it up they'll drag some remark made months ago to clinch an argument against you. Females are such queer creatures—but I beg your pardon," he added apologetically, remembering my sex. "I forgot."

"How many wives have you?" I queried, beginning the interview.

"Well," marking with his claws in the sand as he named over Louisa Mercedes, Cassie, Maud, and a number of others. "I have, as near as I can figure it, about nine now."

"Now?" I repeated.

"Yes. I had more the first of the season, but the folks up at the house have the habit of coming through that door in the barn yonder when the minister comes to dinner and carrying off any

member of my family which strikes their fancy. I don't know what they do with them, I am sure, but presently I hear a dreadful squawk or two in the woodshed, a flouncing around, and then all is still. It is very painful, I assure you," and Mr. Rooster, lifting one foot, pretended to wipe a tear from his sharp, dry eyes.

"You defend them, of course," I responded, endeavoring to appear solemn.

"Of course," swaggered the husband and father, "and sometimes I crow as loud as I can for an hour or so afterward."

"Crow?"

"Yes, to let the folks know *I'm* not conquered."

"Haven't you," I asked, to hide my mirth, "a preference for some of your wives over others?"

Mr. Rooster gravely surveyed his household.

"No," he said reflectively, "no, I can't say that I have."

"But that white one," I said, "over yonder. She is so handsome."

"Maud, that white and silver Wyandotte, you mean. H'm, yes. She's *too* handsome. I have a great deal of trouble with her."

"Trouble—how?"

"Oh, in various ways," with a frown. "She is too pretty to work, she thinks, and spends half her time in preening her feathers, polishing her toe nails, or, what's worse, staring through the fence over yonder at that proud, long-legged Mr. Shanghai. He's a foreign bird, you know, and thinks himself a deal better than a common American Plymouth Rock. There's going to be trouble between us yet, mark my words."

"You have no trouble, I suppose with the older ones," I returned, suppressing a smile.

"No, not in that way, ma'am. They quarrel a good deal about their children, however. Sukey—that brown and white Leghorn over there—thinks her children are veritable little angels with wings, and Georgiana—an out-and-out Plymouth Rock like myself—says they are little demons, her own brood being the little angels, you perceive. Twenty times a day I have to chastise the whole lot, mothers and all. Indeed," with a sigh, "I have a notion to turn them all out some day, just to have peace. All, except Jennie, the black Langshan. She's old to be sure, but a great comfort to me."

"Of course, of course," sneered a voice behind him. "Precious little spunk has Jennie, scratching around from morning till night that she may turn up a bug or worm for a lazy old curmudgeon like you. So you intend to turn me out on the cold, cold world some day, do you? Hm! we'll see about that."

"That's Jane," grinned Mr. Rooster, without turning around, "I hope they will choose her the next time they want one of my household, I really do." [Pg 134]

"Oh, yes," sneered Jane, "you'll run away and squawk as you always do, and leave me to my fate."

"Run away," screamed Mr. Rooster making a dash for her, "I run away!"

"Fie, fie," I exclaimed, "you musn't show your valor by striking one of the weaker sex. You were intended to be her protector, you know."

I was here interrupted by a great commotion among the hens and chicks at the farther end of the enclosure.

"Only a quarrel, I presume," said he indifferently, "they can settle it among themselves, to-day."

"No, it seems to be something rather serious," I responded, and as I spoke a large cat succeeded in squeezing herself through the palings. Wildly ran the fowls about, cackling with fear.

"Hubby, hubby!" cried the hens.

"Papa, papa!" screamed the chicks.

"Run for your lives," admonished that hero, his knees knocking together, his comb and tail drooping, "run for your lives," and suiting the action to the word; away he scurried to the other side, and spreading his wings over the fence he flew, in his blind flight dropping at the feet of his hostile neighbor.

"Get out of here," screamed the young Shanghai, whom the handsome hen admired, "How dare you come over in my yard?"

"Give me time," meekly said my heroic Rooster, "give me time to gain my breath and I will."

"Now is my time," thought the young Shanghai, "the very chance I have been looking for," and straightway into the trembling Mr. Rooster he pitched.

From my standpoint I closely viewed the battle.

"Lo, the conquered braggart comes," I hummed, as a woebegone-looking object in a very little

while dropped wearily over into our enclosure again.

"My poor dear," pityingly cried old Jennie. "Come, Sukey, let's lead him to the trough and bathe his wounded head."

I was about to depart, my heart wrung with compassion at the sight of his wounds, when, lifting his drooping head, with a ghastly wink of his uninjured eye, he said:

"Well!"

"Well!" I echoed in some surprise.

"Didn't I play that trick cleverly?" he asked with a sickly grin.

"Trick?"

"Yes, trick, you stupid! Couldn't you see the pretense I made of running away from the cat, just to get a chance of flying over the fence to get at that impudent Shanghai rooster?"

"But," I gasped, "you didn't whip him, you know."

"Didn't whip him!" he mimicked with brazen effrontery. "Why, how else, I'd like to know, could I have been torn up so? All I want now is a chance at that sneaking cat, and I'll make the fur fly, I warrant you."

Here the old deceiver, overcome with weakness and loss of blood, staggered, and would have fallen but for the Support of the faithful Jennie and Sukey.

"Go away," hoarsely muttered the rooster, "go away; what do females know about war. They can't crow! Go away!"

I bethought me here of one very important question.

"I hesitate," I said, "to disturb a suffering creature, but—"

"Call to-morrow, Miss Reporter," he muttered wearily, "call to-morrow."

"But," I persisted, "you may not be alive to-morrow, and I only desire to know why you roosters invariably crow at midnight?"

"Midnight!" he echoed faintly, catching but the last word. "Is that the reason it has grown so dark? Ah, that Shanghai over there will get ahead of me; that'll never do," and the dying old boaster, drawing himself up stiffly, a feeble "*cock-a-doodle*" rang out on the air, but the final "*doo*" stuck in his throat, a gasp, a shiver, a swaying to and fro, and the long, slender toes of Mr. Rooster were presently turned toward the sky.

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BROOK TROUT.

Salmo fontinalis.

THIS well-known and greatly prized game fish is found between the parallels of latitude 50 degrees north and 36 degrees south, though in Labrador, in latitude 54 degrees, and in the Appalachian mountain ranges as far south as the northern border of Georgia and South Carolina, it has been taken in abundance. Northwestern Minnesota is its northern limit, and it is only occasionally caught west of the Mississippi River, except in a few of its tributaries. Specimens weighing seventeen pounds have been taken, the largest being found in the Nipigon River, in Ontario, and on the north shore of Lake Superior, where the seventeen-pound specimen referred to was caught. It is found in the large lakes and in the smallest ponds, the tiniest brooks and the largest rivers. The Nipigon River is forty-five miles in length and has a depth, in places, of from one hundred to two hundred feet.

Although a bold biter, the brook trout is wary, and usually requires all the skill of an experienced fisherman to capture it. The bait commonly used to entice it to bite is artificial or natural flies, minnows, crickets, grubs, grasshoppers, fish spawn, or the eyes or cut pieces of other trout. Its period of spawning is from September to the last of November, and it begins to reproduce its kind when about two years of age, when it measures some six inches in length. In the early summer the trout sports in rapids and swiftly running water, and in midsummer finds a retreat in deep, cool, and shaded pools. In August and September the females gather about the mouths of gravelly brooks, whither they resort to make their spawning beds.

With age the habits of the trout change. When young they associate in schools and play together constantly, usually choosing parts of the brook where the bottom is muddy, in which, if startled suddenly, they bury themselves for safety. This does not often occur, however, as they prefer any little projection that juts out over the water where they can hide until the danger is past. As they grow older they separate, and each one chooses his own particular hiding-place, the larger trout taking the deepest holes and largest projections and leaving the smaller relations to shift for themselves. The older they grow the wiser and more wary they become, hence the necessity of considerable skill to land a wary old trout. Angle-worms are considered the best bait for trout, but in the spring, after the usual freshets, which wash vast numbers of worms and insects into the water, they bite better at the more tempting bait of a fly.

Practice alone will enable one to catch this wary beauty. One must know not only how to catch it but where to find it, and some knowledge of entomology is essential at the very beginning. It is desirable to have some acquaintance with the insects that live in the water, under the water, and over the water, and whose habits in great part influence the movements of the fish.

Miss Sara J. McBride, an accomplished naturalist of Mumford, New York, in an essay published some years ago in the *Forest and Stream*, taught the lesson of entomology we have referred to, as applied to the angler's purposes, in the following words:

"There is a large order of insects that live the first stages of life in water, where for weeks, months, in some instances years, they hide under stones; carve an abiding-place in submerged driftwood; feed on decaying vegetation in lazy, inert masses; burrow in the earth beneath the current; weave together bits of wood, gravel, stones, and floating debris, forming retreats that surround them as they swim or daintily walk; spin of silken thread individual domiciles that they guard from intruders with the valor of soldiers, or bodily and singly dash out in the current, swimming with agile rapidity. These are all fish food. But it is only when they assume the perfect form, when they cast aside their aquatic nature, and with gossamer wings float in the air, that they are of interest to the fly-fisher—as he seeks to deceive the finny tribe with their imitations, made of feathers, tinsel, and mohair. Insects are enfeebled at all changes in their life, and at each successive moult, when the pupa case is broken, too weak to keep guard, they flutter and rest on the water an instant before flitting away. At this instant many are seized by the wary fish. Insects leave the water mornings and evenings, particularly the latter, rarely at midday, never during rain storms or heavy winds. It is at these times, when they are leaving the water, their imitations are used to most advantage. It is that insect floating off into a new element that the fish are watching and waiting to feed on. At other times you may cast with success your favorite 'brown hackle' with its golden ribs and steel backbone—the bland professor, the modest queen of the water, or the grizzly king with his gray locks and flaming sword. Things which resemble nothing in the heavens above, the earth beneath, or the waters under the earth—why fish take these, whether from curiosity, or by way of dessert, no one perhaps will ever know, not fully understanding the nature of the fish. But there is one thing we do know, that when the countless myriads of these tiny creatures are entering a new life in untried regions, the favorite flies will be thrown in vain. The fish will regard with contemplative indifference every other lure but a close imitation of that particular insect.

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"One evening we sat on the bank of a creek, bug net in hand, watching the trout and the birds of the air feeding on a neuropterous insect that is constantly repeating the cycle of its life,

'As yet unknown to fame,
And guiltless of a Latin name.'

The stream was in eddying whirls of ripples from the constant 'leaping' of the trout. Now and then one bolder than the rest would dash out of the water its full length to seize its departing prey, which sometimes escaped to become a precious morsel in the mandibles of a watching bird.

Many of these insects would float on with the current, never able to unfold their soft, creamy-wings, and become easy victims. On the opposite bank was an angler. For an hour in patience he whipped the stream, now up, now down, with 'red hackles,' 'white hackles,' 'black hackles;' he changed fly after fly in vain. At length he folded his rod and passed away among the shadows of the night, without so much as a bite, without so much as a chance to tell of the big fish 'hooked' but lost.

"There are many aquatic insects double brooded, or under favorable circumstances, of a succession of broods. Imitations of such can be used throughout the summer months. There are many insects that do not breed in water, yet are successful baits. As a rule, insects that appear in large numbers, whether they belong to land or water, are the proper ones for imitation. Solitary specimens, although dear to the heart of an entomologist, are eyed by the fish with haughty indifference. Water is a great attraction for all insect tribes. The banks of streams constitute the favorite hunting-ground for insect collectors, where they compete with the fish, those practical entomologists, in collecting. Some insects come to drink, others in search of prey, for insects are cannibals, while very many are the sport of the winds. It is probably the bright sheen of the water that draws the fluttering moths into its depths. All nocturnal insects have a strange infatuation for glistening light. What the attraction is for some is beyond the ken of mortals. A *Tipulidæ bibri marci*, or in piscatorial language, the hawthorn fly, an insect whose life is beneath the surface of the earth eleven months of the year, comes crawling, creeping out of the ground on warm June mornings appareled in new livery. After resting awhile on low herbage, all, as if guided by one impulse, fly to the nearest stream. We have kept those insects for weeks in confinement, and they would neither eat nor drink. But every morning for hours they congregate over streams. Keeping time with the ripple of the water, they hold a May dance; darting hither and thither, occasionally touching the water to go down the current, or else down the throat of a fish.

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When these bright creatures are holding high carnival above, the trout positively refuse other enticement. The larvae of moths is a favorite fish food, and consequently successful bait. Hibernating larvae are drawn from their retreats in warm spring days, and continue the pilgrimage they commenced the previous fall. In their wild journeyings on and on before spinning the pupa shroud, they fall victims in attempting to cross streams.

Hairy caterpillars feeding on the trees are blown off by the winds, or their silken thread is broken, as they hang under the leaves in shelter from the rain. Imitations of those known to the American by the familiar term of hackles are to be used after winds or during rain storms; also that compromise between larvae and image known as the hackle fly. No bait has ever been used that has given as general satisfaction as this anomaly. It is a common remark that fish will not bite before rain. The reason is probably that food is never offered at such times. The natural instinct of the insect forbids its leaving the water or flying abroad if rain is threatening. The breathing-pores are situated on the outside of the body near the insertion of the wings. They are soon clogged and closed up by the water, and the down washed from their bodies; their wings draggle and become powerless, and they suffocate flying in midair. This is the reason winged insects on touching water drown so easily. Insects do not invariably appear at the same times. A cold spring will retard their development for months, while an unusually warm spring or summer will hasten their appearance. Insects in the water are the most affected by changes of temperature. Any guide for a fly-fisher would be almost useless unless this important point were remembered. English works can never become positive authorities for our climate. Insects which appear there in vast quantities are rare here, and *vice versa*. Some that are single-brooded there are doubled-brooded here. Some that appear there in one month visit us at another, while we have many alluring baits here that the classic waters of the British Isles would regard with bewildering amazement."

In fishing with worm for bait, good fishermen say, it is better to choose a still, cloudy day indicating rain, as the fish are then hungry for insects. An expert trout-fisher will begin at the head of a stream and fish down it, always keeping some distance from the bank to avoid alarming the fish.

The speckled beauty, as the brook trout is universally called, as a food fish is by many considered unsurpassed, the flesh being firm and well flavored. Others, however, regard it as only an occasional delicacy.

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CUBA AND THE SPORTSMAN.

DEER, WILD BOAR, AND MANY SPECIES OF GAME BIRDS FOUND IN ABUNDANCE—WATERS TEEM WITH FISH.

WHILE Cuba offers such a haven to the invalid, it is a paradise to the sportsman, wild game and fish of all kinds being abundant.

Parties of gentlemen on horseback, with their pack of hounds, hunt the fleet-footed deer. It is a common thing for a small party to kill eight or ten deer in a day.

The wild boar is plentiful, and sometimes, if cornered, dangerous, especially the old master of the herd, called "un solitario," which will tear a dog to pieces or make a green hunter climb a tree; but a Cuban easily kills him with a machete. The island boar sometimes weighs 200 or 300 pounds and has huge tusks, often five or six inches in length. The meat of the female is much relished by the natives. Wild dogs and cats, wild cattle, horses, and jackasses abound. But the jutia, peculiar only to Cuba, which looks like a cross between a squirrel with a rat's tail and a rabbit, and which lives in the trees and feeds on nuts and leaves, is the great delight of the Cuban.

Fowls are in great numbers. Wild guinea hens and turkeys are found in flocks of from 25 to 100. The whistle of the quail and the flutter of the perdiz, or pheasant, are heard on all sides in the rural and mountain regions. Ducks in abundance come over from Florida in the winter and return with the spring. Wild pigeons, with their white tops and bodies of blue, larger somewhat than the domestic bird, offer, in hunting, the greatest sport to gentlemen who will be restrained within reason. In the early morning the pigeons generally go to feed on the mangle berries when ripe, and which grow by the sea or near some swampy place. I have known a party of three persons to kill 1,500 of the pigeons within a few hours. Robiches, tojosas, and guanaros are found in the thick woods.

Mockingbirds and blue-birds, orioles, turpials, negritos, parrots, and a thousand kinds of songsters and birds of brilliant plumage flit from tree to tree.

The naturalist Poey says there are 641 distinct species of fish in the Cuban waters. Among those that delight the sportsman are the red snapper, lista, manta, gallego, cubera, surela, and garfish. The sierra, which weighs from forty to sixty pounds, is extremely game, as is the ronco, so called because it snores when brought out of the water. For heavy sport, fishing for sharks, which are good for nothing, or the gusa, which weighs from 400 to 600 pounds and is excellent eating, offers abundant exercise. It is a daily occurrence to see schools of fish numbering from hundreds to many thousands, each fish weighing from one to four pounds, swimming around the bays and harbors waiting for a bait. Any American who enjoys good fishing can find his fondest dreams more than satisfied in Cuba.

Delicious shrimps, crabs, lobsters, oysters, and clams abound. The lobsters have no claws and weigh from two to eight pounds. They are caught at night in shallow places along the sandy beach, a torch, harpoon, and net being the necessary outfit. Some of the rivers abound in alligators, but few hunt them.—*Field and Stream.*

280. NIAGARA FALLS. CHICAGO, A. W. MUMFORD, PUBLISHER.

NIAGARA FALLS.

NIAGARA FALLS, the grandest cataract in the world, belong in part to the state of New York. Here the water of the great lakes, west of Ontario, is poured over a precipitous cliff about 160 feet high in two immense sheets, called the American and Horseshoe falls, separated by Goat Island. These falls received the name Niagara from the aborigines, Ni-a-ga-ra meaning the "thunder of waters." The roar created by the fall can be heard, under favorable conditions, at a distance of fifteen miles. There are three distinct falls. The Horseshoe fall, so named on account of its crescent shape, is the largest, covering a distance of 2,000 feet and having a fall of 154 feet; the American fall, 660 feet, and the Central fall, 243 feet in width, each have a fall of 163 feet. The volume of water is perpetually the same, no amount of rain or snow making any apparent change. This is conceded to be the grandest natural feature in the world, providing a water power the limit of which is incalculable.

Many of our readers have visited the falls in the summer season and doubtless all of them have read descriptions of them, more or less disappointing; everyone is familiar with the numberless photographs and engravings that have been made of them. Of course, no adequate idea of them has ever been given to the imagination. The writer has seen them many times and must confess to a want of sympathy with that feeling of wonder and bewilderment which many people claim to experience when first beholding them. It would be interesting to compile a list, if it could be done, of exclamations made on first viewing Lake Erie, as it really is, tumbling over a gigantic cliff. Charles Dickens is reported to have been unable to utter a word for many seconds, and there does not appear to be an adjective of sufficient potentiality to hold the idea of its majesty. And yet there are falls greater than these in the world. Dr. Livingstone, alluding to Victoria Falls in Central Africa, declared that of all the wonders of the lands he had visited he had seen no such stupendous spectacle as they. The chasm into which a mile-wide sheet of water plunges has been plumbed to twice the depth of Niagara.

The Niagara River is the channel by which all the waters of the lakes flow toward the Gulf of St. Lawrence. It has a total descent of 330 feet. The interruption to navigation occasioned by the rapid descent of the Niagara River is overcome on the Canadian side by the Welland Canal; on the American side the communication between tide-water and the upper lakes was first effected by the Erie Canal. The river flows in a northerly direction with a swift current for the first two miles and then more gently, with a widening current, which divides as a portion passes on each side of Goat Island. As these unite below the island the stream spreads out, about two or three miles in width, and appears like a quiet lake studded with small, low islands. About sixteen miles from Lake Erie the river grows narrow and begins to descend with great velocity. This is the commencement of the rapids, which continue for about a mile, the water falling in this distance about fifty-two feet. The stream terminates below in a great cataract. At this point the river, making a curve from west to north, spreads out to an extreme width of 4,750 feet. Goat Island, which extends down to the brink of the cataract, occupies one-fourth of this space, leaving the river on the American side about 1,100 feet wide and on the Canadian side about double this width. A cave, called the Cave of the Winds, is formed behind the fall, into which, on the Canadian side, persons can enter and pass by a rough and slippery path toward Goat Island. As already stated, there are many cataracts which descend from greater heights. The sublimity of [Pg 144] Niagara is in the vast power displayed by a mighty current flowing down the long rapids and finally plunging in one uniform sheet into the abyss below. Dangerous as it appears, the river is here crossed by small rowboats. For seven miles below the falls the narrow gorge continues, varying in width from 200 to 400 yards. The river then emerges at Lewiston, N. Y., having descended 104 feet from the foot of the cataract. A suspension bridge was constructed in 1855 by Mr. Roebling, for the passage of railway trains, and eighteen feet below the railway it also sustains a carriage and foot track. From this bridge a fine view is had of the falls. Other bridges have since been built, among them a cantilever.

Geologists say that the gorge through which the Niagara River flows below the falls bears evidence of having been excavated by the river itself. Within the present century changes have taken place by the falling down of masses of rock, the effect of which has been to cause a slight recession of the cataract and extend the gorge to the same distance upward toward Lake Erie. Table Rock, once a striking feature of the falls, has wholly disappeared. Father Hennepin made a sketch of the falls in 1678, a facsimile of which shows that many striking features have disappeared. In 1750 the falls were visited by Kalm, a Swedish naturalist, whose description of Niagara was published in 1751. He alludes to a rock having fallen down a few years previous and indicates the spot in his sketch. Lyell estimates the retrocession of the falls to be about a foot a year.

Of late years the extraordinary power of the falls has been adapted to the production of electricity, which has been distributed to various cities and towns within a radius of 100 miles. Street cars and machinery of every kind are run by them, and, by new devices and more powerful dynamos, it is believed the field for the successful utilization of this great force is almost without limit.

HOW THE WOODPECKER KNOWS.

How does he know where to dig his hole,
The woodpecker there, on the elm tree bole?
How does he know what kind of a limb
To use for a drum, or to burrow in?
How does he find where the young grubs grow—
I'd like to know?

The woodpecker flew to a maple limb,
And drummed a tattoo that was fun for him.
"No breakfast here! It's too hard for that,"
He said, as down on his tail he sat.
Just listen to this: rrrrr rat-tat-tat.

Away to the pear tree out of sight,
With a cheery call and a jumping flight!
He hopped around till he found a stub,
Ah, here's the place to look for a grub!
'Tis moist and dead rrrrr rub-dub-dub.

To a branch of the apple tree Downy hied,
And hung by his toes on the under side.
'Twill be sunny here in this hollow trunk,
It's dry and soft, with a heart of punk,
Just the place for a nest!—rrrr runk-tunk-tunk.

"I see," said the boy, "just a tap or two,
Then listen, as any bright boy might do.
You can tell ripe melons and garden stuff
In the very same way—it's easy enough."

—*Youth's Companion.*

Transcriber's Note:

- Minor typographical errors have been corrected without note.
- Punctuation and spelling were made consistent when a predominant form was found in this book; otherwise they were not changed.
- Ambiguous hyphens at the ends of lines were retained.
- Mid-paragraph illustrations have been moved between paragraphs and some illustrations have been moved closer to the text that references them.
- The Contents table was added by the transcriber.

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