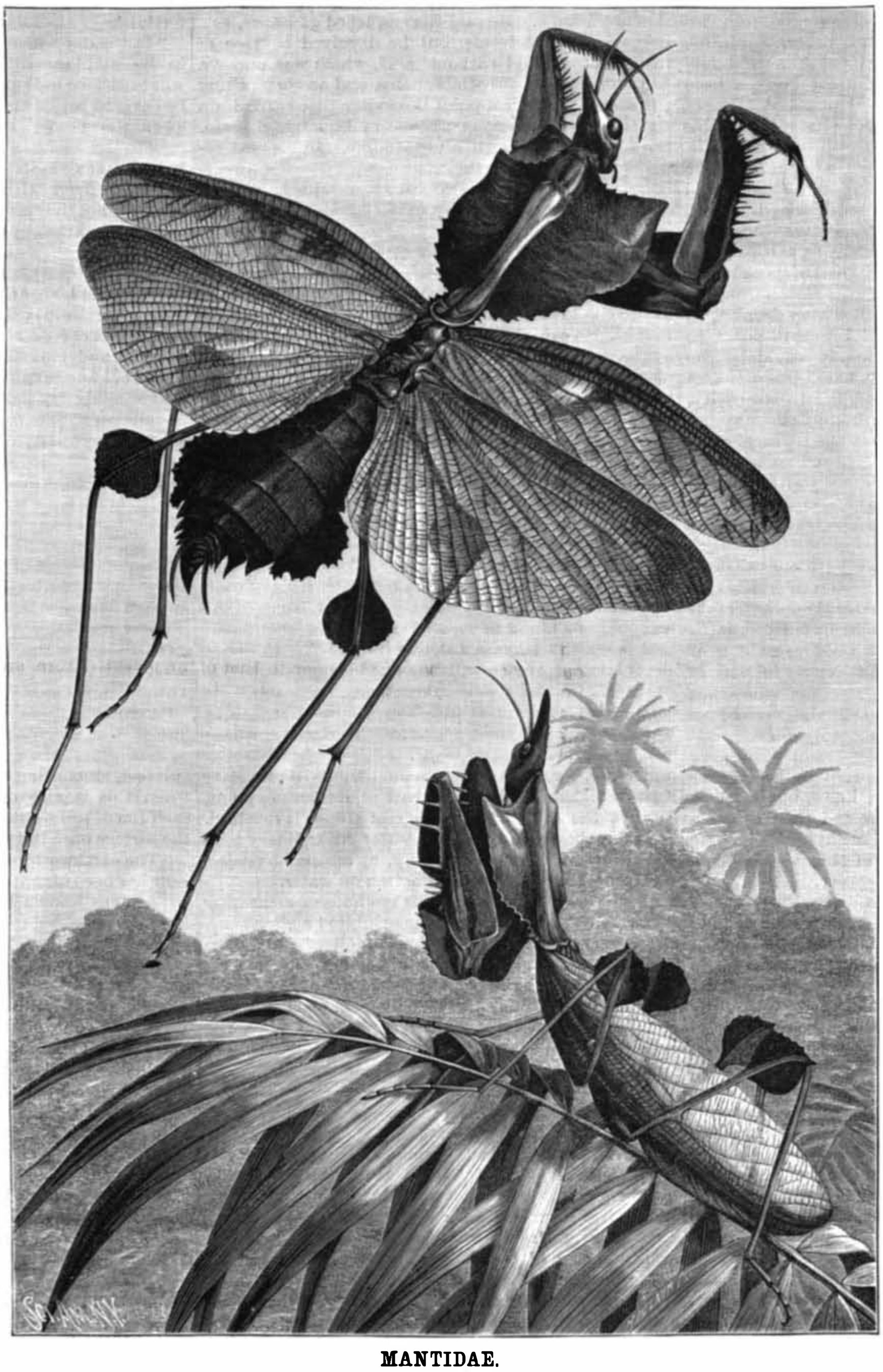
MANTIDAE.

When we hear the word "locust" we immediately think of devastated fields, famine, and despairing human beings, and we also remember what we were taught during our first years at school about Moses, Pharaoh, and the seven plagues. But we are unjust when we class all the genera of orthopter together, as they are not all "vegetarians," to be dreaded by the farmer and gardener. We must divide them into two groups, the jumpers and the walkers. The members of the former group, to which the ill-famed migratory locusts and the common green grasshopper belong, live on plants, although they do not scorn an occasional fat caterpillar; and they are quick in their movements, flying and jumping, for their long legs permit this latter movement. The males make a peculiar whirring or chirping sound. Those of the second group, which includes the praying mantis and the specter or walking stick, are not musical. They move deliberately, fly little or are entirely incapable of flying, and live exclusively on insects or exclusively on plants. The mantis is one of the insect eaters.

The mantidae are voracious creatures of prey, and like all of this character, live alone. They are the oddest of insects. Their wings lie close, the posterior wings overlapping slightly instead of meeting like the parts of a roof, as do those of the grasshopper; the foremost breast wing is lengthened considerably and carries the little head with its great eyes and short feelers; but their fore legs constitute their most noteworthy feature. There is nothing peculiar about the two other pairs of legs, they are simply rather slender limbs which permit a slow movement; but the fore legs, which are never used in going from place to place, are so constructed as to serve as formidable weapons. The hip portions are unusually long, and the thighs pressed together sidewise and furrowed lengthwise underneath. The sharp edged second joint fits into this furrow, that is provided on the edges with pointed prickers, as the blade fits into the handle of a pocket knife. These legs are their graspers, and the only creature that has anything similar is the lobster. The mantis does not touch these legs to the ground, but holds them closed in such an amusing attitude (see the lower figure in the accompanying cut) that he has received a long list of undeserved names from the people; such as, Gottesanbeterin in German, Louva-dios in Portuguese, Preque dieu or Precheur in French dialect, and in English praying mantis or soothsayer. All of these names indicate a misunderstanding of the object with which the creature holds its fore legs folded and raised; it would seem as if it were praying, but, in reality, this is only the mean mask of Tartuffe, or the artifice of the robber. I have only had opportunity to observe in Trieste the common green mantis (Mantis religiosa L.), which now reaches its northern limit near Vienna or Brunn, and in the neighborhood of Freiburg in Breisgau, but in the last century was found, according to Leydig, near Wurzburg and Frankfort a. M. All communications received in regard to the habits of those that live in the temperate and tropical countries of both hemispheres, however, agree with my observations. The creature sits as shown in the illustration, the only movement being in the head, which it turns back and forth as it looks on all sides. These motions would seem very strange to a naturalist who had only observed other insects. Now one of the flies which I put in the glass for the mantis approaches it and settles on its green wing, which, to the fly, does not look different in any way from a leaf. The expectancy of the spectator and of the hungry mantis increases; the victim crawls heedlessly forward, now it comes within reach of the graspers, the knife opens and snaps together, the struggling, confiding fly is caught and soon every particle of it has disappeared. The mantis assumes its former attitude and waits, greedy fellow that he is, for a new victim.

It is stated on good authority that the tropical species (one of which is shown in our illustration) will overpower and eat lizards three times as long as themselves, and even small birds are surprised while sleeping and devoured. The little Mantis religiosa of Southern Europe, although less than three inches long, will defend itself against man, and the gigantic species of hot countries cause bloody wounds in the human skin with their saber-like legs. But the worst characteristic of the mantis is the amazon-like trait which it shares only with some spiders. The female mantis is larger and stronger than the male, and she murders her mate in cold blood, when she can get him, and eats the father of her future children without the least compunction. The creatures are always quarrelsome among themselves, the stronger kills the weaker, and brothers and sisters wage war against one another from the first.



MANTIDAE.

A creature of prey which is capable of only a slow movement, and cannot capture its victims by rapidity of pursuit or suddenness of attack, must have some other means of taking them by surprise, and such a means is invisibility. Let me be rightly understood. I mean relative, not absolute invisibility, which the mantis obtains by the coloring and form of its body, more especially of its fore wings, which are of such a nature that the creature does not seem to stand out from the ground on which it awaits its prey and is not distinguishable from the leaves and other parts of plants. Some are bright green, like the Mantis religiosa of Europe, so that they resemble fresh leaves; others are yellow, like faded foliage; and still others are a brown or leather color, with dark spots and glassy, transparent places on the fore wings, so that they look like an old weatherbeaten leaf to which fungi have attached themselves, and parts of the epidermis of which have been removed by insects and the influence of the weather, so that its ribs and nerves resemble the veins of the mantis wings.

Scientists who have explored tropical countries and other travelers that understand nature—there are, unfortunately, few of the latter—agree that the mantis is wonderfully protected by its resemblance to foliage. This fact has not escaped the notice of the masses in those hot countries and has given rise to all kinds of superstitions. The noted painter, Marie Sibylle Merian, of Frankfort a. M., who remained in tropical South America specially to paint insects and flowers, says that in Surinam it is supposed that the creature grows, as leaves do, on trees, falls off after a time, and then flies or crawls away. A superstition which is just the opposite of this is related by Wilhelm Piso (1658) in his "Naturgeschichte Brasiliens" (Natural History of Brazil). He says the creature changes to a plant; fixing its feet in the ground, roots are caused to grow by the influence of moisture.

The species shown in our engraving is named Idolum diabolicum, and is a native of the interior of Africa. Its most remarkable features are the sidewise widening of the thorax, which is sharp edged, and of the abdomen. The lower ends of the second joints of the legs are also broadened out in leaf shape. A glance at the fore feet with their armature of spines will show us what terrible weapons they must be. The helmet-shaped projection on the head is peculiar to several tropical species.—*Illustrirte Zeitung.*

Importance of Bacteria.

"We must not think too hardly of bacteria," says Dr. H. W. Conn, of Middletown Wesleyan University. "It is true that they are the causes of evil, that they produce disease; but it is also true that they do good. They are our enemies, but they are also our closest allies. It is true that without them we could not have our smallpox nor our yellow fever, we could not have our diphtheria nor our scarlet fever, neither should we have any of the epidemics. But when we remember that it is through the agency of these organisms that we bake the loaf of bread that comes to our table; that the immense brewing industries connected with the manufacture of alcoholic liquors are possible; that without them we could not get our vinegar or our lactic acid; that without them we could not make our ensilage; that these bacteria give the butter maker the aroma of his butter; that it is the decomposition products of the bacteria that the cheese manufacturer sells in the market; when we remember their agency as scavengers, how it is that they keep the surface of the earth clean and in a constant condition for the growth of plants; their value to the soil in decomposing the dead bodies of animals and plants, and thus enabling the same material to be used over and over again for the support of life; and lastly that it is only through their agency that plants were originally enabled to get hold of nitrogen at all, and that we may hope for a continuance of a supply of nitrogen to the soil—we will recognize that the power of bacteria for good far outweighs their power for evil."

THE largest telephone switchboard in the world is that in the Exchange at Berlin, Germany, where 7,000 wires are connected with the main office.

Squinting Brains.

All of our brains squint more or less. There is not one in a hundred, certainly, that does not sometimes see things distorted by double refraction, out of plumb or out of focus, or with colors which do not belong to it, or in some way betraying that the two halves of the brain are not acting in harmony with each other. You wonder at the eccentricities of this or that connection of your own. Watch yourself, and you will find impulses which, but for the restraints you put upon them, would make you do the same foolish things which you laugh at in that cousin of yours. I once lived in the same house with the near relative of a very distinguished person, whose name is still honored and revered among us. His brain was an active one, like that of his famous relative, but it was full of random ideas, unconnected trains of thought, whims, crotchets, erratic suggestions. Knowing him, I could interpret the mental characteristics of the whole family connection in the light of its exaggerated peculiarities as exhibited in my odd fellow boarder. Squinting brains are a great deal more common than we should at first sight believe. Here is a great book, a solid octavo of five hundred pages, full of the vagaries of this class of organizations. I hope to refer to this work hereafter, but just now I will only say that, after reading till one is tired the strange fancies of the squarers of the circle, the inventors of perpetual motion, and the rest of the moonstruck dreamers, most persons will confess to themselves that they have had notions as wild, conceptions as extravagant, theories as baseless, as the least rational of those which are here recorded.

I have not ventured very often nor very deeply into the field of metaphysics, but if I were disposed to make any claim in that direction, it would be the recognition of the squinting brain, the introduction of the term "cerebricity" corresponding to electricity, the idiotic area in the brain or thinking marrow, and my studies of the second member in the partnership of I-My-Self & Co.

Whether we shall ever find the exact position of the idiotic center or area in the brain (if such a spot exists) is uncertain. We know exactly where the blind spot of the eye is situated and can demonstrate it anatomically and physiologically. But we have only analogy to lead us to infer the possible or even probable existence of any insensible spot in the thinking center. If there is a focal point where consciousness is at its highest development, it would not be strange if near by there should prove to be an anæsthetic district or limited space where no report from the senses was intelligently interpreted. But all this is mere hypothesis.

There is a great good to be got out of a squinting brain, if one only knows how to profit by it. We see only one side of the moon, you know, but a fellow with a squinting brain seems now and then to get a peep at the other side. I speak metaphorically. He takes new and startling views of things we have always looked at in one particular aspect.

There is a rule invariably to be observed with one of this class of intelligences: Never contradict a man with a squinting brain. I say a man, because I do not think that squinting brains are nearly so common in women as they are in men. The "eccentrics" are, I think, for the most part of the male sex.

Are not almost all brains a little wanting in bilateral symmetry? Do you not find in persons whom you love, whom you esteem, and even admire, some marks of obliquity in mental vision? Are there not some subjects in looking at which it seems to you impossible that they should ever see straight? Are there not moods in which it seems to you that they are disposed to see all things out of plumb and in false relations with each other? If you answer these questions in the affirmative, then you will be glad of a hint as to the method of dealing with your friends who have a touch of cerebral strabismus, or are liable to occasional paroxysms of perversity. Let them have their head. Get them talking on subjects that interest them. As a rule, nothing is more likely to serve this purpose than letting them talk about themselves; if authors, about their writings; if artists, about their pictures or statues; and generally on whatever they have most pride in and think most of their own relations with.

Perhaps you will not at first sight agree with me in thinking that slight mental obliquity is as common as I suppose. An analogy may have some influence on your belief in this matter. Will you take the trouble to ask your tailor how many persons have their two shoulders of the same height? I think he will tell you that the majority of his customers show a distinct difference of height on the two sides. Will you ask a portrait painter how many of those who sit to him have both sides of their faces exactly alike? I believe he will tell you that one side is always a little better than the other. What will your hatter say about the two sides of the head? Do you see equally well with both eyes, and hear equally well with both ears? Few persons past middle age will pretend that they do. Why should the two halves of a brain not show a natural difference, leading to confusion of thought, and very possibly to that instinct of contradiction of which I was speaking? A great deal of time is lost in profitless conversation, and a good deal of ill temper frequently caused, by not considering these organic and practically insuperable conditions. In dealing with them, acquiescence is the best of palliations and silence the sovereign specific.—*Dr. O. W. Holmes.*

The Chemistry of Gases.

Professor Dewar recently delivered a lecture on the above subject at the Royal Institution, London, of which the *Engineer* gives the following abstract. He began by explaining that the critical density of a substance is about one-third that of its fluid density. He performed various experiments with carbonic acid gas at and near its critical point, and made the results visible by projection on the screen; the liquid acid was contained in a glass tube, and the critical point was reached by cautiously pouring hot water over the outside of the tube. He said that liquefied gases are, as a rule, not good solvents; but he dissolved a trace of iodine in the liquid carbonic acid, which was under a pressure of about 100 atmospheres, and on then raising the acid to its critical point the iodine was carried up the tube by convection currents; in liquefying again, the acid carried down all the iodine. In his next experiment he raised to the critical point some liquid carbonic acid to which a trace of essential oil had been added—he did not say what essential oil. On liquefying again, the solution separated into numerous layers, each of different relative composition.

Professor Dewar then spoke of the solidification of a body by cooling itself, and said that water can be made to become solid by the evaporation of a quarter of its weight. He exhibited 5 inches of liquid carbonic acid in a tube, and on opening the capillary end of the tube by means of a small blowpipe flame, the rapid evaporation of the acid caused the formation of about one-half inch of solid carbonic acid in the tube, or not more than 10 per cent. He then drew attention to a great inverted iron gas bottle, suspended under a strong tripod, and said that it was three-quarters full of liquid carbonic acid; the total weight of the bottle and acid was 108 pounds; that of the acid alone was 4 pounds. The nozzle of the bottle was inserted in the mouth of a long narrow bag, and tap turned on. The escaping carbonic acid then by evaporation froze a portion of itself into carbonic acid snow, which deposited itself in the bag, and was found to weigh 30 per cent of the liquid acid used; this Professor Dewar stated to be an excessively large yield, the ordinary yield being but 15 or 20 per cent. Carbonic acid snow floats on water. He compressed some of it into ice, and then it sank in water, of which it had 1½ times the density; it was nearly transparent. It evaporated slowly, and without liquefying, for it is a boiling solid. In its liquid state it has a higher temperature than at its boiling point, so that the ordinary condition of things is reversed. Liquid carbonic acid floats on water at ordinary temperatures, and Professor Dewar, by means of projection apparatus, exhibited it floating on water.

As an instance of one of the methods of measuring abnormally high pressures, he exhibited a glass tube, closed at one end, silvered inside, full of air, and inverted over mercury. All this was put inside a vessel subjected to the action of the hydraulic pump until a pressure of 500 atmospheres had been reached. The rising mercury ate away the silver; so that when the tube was taken out and examined it could be seen into what compass the air had been compressed.

Work of Earth-Worms in Yoruba Country, West Africa.

In the "Proceedings of the Royal Geographical Society," October, 1891, Mr. Alvan Millson gives the following account of the extraordinary work done by West African earth-worms:

"Northward from Ibadan, which may be described as the center of the chief military and commercial power in Yoruba, two days' journey—about forty miles—through many villages, and a landscape dotted far and near with oil palms (*Elais guineensis*), along a road thronged with travelers, brings one to the capital of central Yoruba, Oyo (Awyaw). On leaving Ibadan, I passed in the course of our morning's march over 4,700 men, women, and children, hurrying into the great city from the farm villages, with loads of maize, beans, yams, yam flour, sweet potatoes, fowls, pigs, ducks; or driving cattle, sheep, and goats; or mounted on small native horses which amble quickly along under the combined influence of an Arab ring bit and an armed spur, which leaves its traces in deep scores along the flanks of the poor animals.

"Far and wide the land has, for generations, and indeed for centuries, been cultivated by these industrious natives. The hatchet, the fire, and the hoe have removed all traces of the original forest, save indeed where a dark trail of green across the landscape shows where the valley of some narrow watercourse or larger river is hidden among trees.

"For two or three years at most the land is allowed to lie fallow, while for three or four years double or treble crops are raised with no further cultivation than an occasional scrape with a hoe, and during its fallow time no further care is taken of it than to let a rank growth of reedy grass spring up some six or eight feet in height. Among this grass can be seen the seedlings and young plants of a new forest which would rapidly take possession were the land to be permanently deserted.

"In spite of this careless and exhausting method of cultivation the crops maintain an excellent average, and the same plot of ground serves for generations to support its owners.

"The following extracts taken from notes taken at the time will serve to explain the apparently inexhaustible fertility of a soil which does not at first sight show any signs of unusual richness.

"Were one to visit Yoruba during the early part of the rainy season only, it would appear impossible to account for these facts, . . . while under our feet, unnoticed, was going on the ceaseless labor of the real fertilizers of the land.

"In the dry season the mystery is at once solved, and in the simplest and most unexpected manner. The whole surface of the ground among the grass is seen to be covered by serried ranks of cylindrical worm casts. These worm casts vary in height from a quarter of an inch to three inches, and exist in astonishing numbers. It is in many places impossible to press your finger upon the ground without touching one. For scores of square miles they crowd the land, closely packed, upright, and burned by the sun into rigid rolls of hardened clay. There they stand until the rains break them down into a fine powder, rich in plant food, and lending itself easily to the hoe of the farmer. Having carefully removed the worm casts of one season from two separate square feet of land at a considerable distance from one another, and chosen at random, I find the result to weigh not less than ten and three-quarters pounds in a thoroughly dry state. This gives a mean of over five pounds per square foot. Accepting this as the amount of earth brought to the surface every year by these worms, we get somewhat startling results. I may say, speaking from the result of numerous experiments, that five pounds is a very moderate yearly estimate of the work done by these busy laborers on each square foot of soil. Even at this moderate estimate, however, of the annual result of their work, we have a total of not less than 62,233 tons of subsoil brought to the surface on each square mile of cultivable land in the Yoruba country year after year, and to the untiring labors of its earth-worms this part of West Africa owes the livelihood of its people. Where the worms do not work, the Yoruba knows that it is useless to make his farm.

"Estimating one square yard of dry earth by two feet deep as weighing half a ton, we have an annual movement of earth per square yard to the depth of two feet, amounting to not less than forty-five pounds. From this it appears that every particle of earth in each ton of soil to the depth of two feet is brought to the surface once in twenty-seven years.

"The earthworm which produces such surprising results has been identified as a new species of *Siphonogaster*, a genus known hitherto only in the Nile Valley."

Arizona Onyx.

Arizona onyx is fast gaining a reputation in the East, and the day is not far distant when most of the onyx used in the United States will come from this Territory. The great beds of this precious stone in Yavapai and Maricopa Counties alone, when sufficiently developed, will supply a greater part of the demand. Even now from two to five car loads are shipped from the Yavapai beds, and arrangements are being made to increase the output, and by the 5th of May, teams will be moving several tons a day from the Cave Creek mines.

The Yavapai onyx beds, owned by W. O. O'Neil and partners, are probably the most extensive mines of the kind known, being almost a solid body one mile by one mile and a half in extent. At present about forty men are engaged in taking out the stone that is being shipped to Chicago, New York, Cincinnati and other Eastern cities, where it is worked into table tops, etc. Probably the largest slab of oynx ever taken out in one piece was dug out of the O'Neil ledge, it being 23 × 10 feet, and 26 inches thick. The stone from this claim is very fine grain and takes a much higher polish than the celebrated onyx of Mexico, and it contains colors that were exhausted many years ago in the Mexican mines. Then, too, the mines of that country never turned out pieces larger than five or six feet square. So far as developed, the Cave Creek onyx beds do not seem to be as large as the Yavapai beds, though the stone is as fine, but even as they are, they will produce large amounts and in blocks of very satisfactory size. J. B. Dougherty, of New York, is doing a great deal of development work, and as soon as the road is completed, which will be in a few days, he will put teams to hauling and loading it on to the cars at Phenix, for shipment to New York.—*Phenix Gazette.*

THE recent performance of the steamer City of New York was 20·06 knots per hour throughout the voyage from New York to Queenstown, 2,896 miles.

Modern Aerial Navigation.

Captain J. D. Fullerton lately read a paper at the Royal United Service Institution on "Modern Aerial Navigation," concerning which *The Engineer* makes the following observations:

The paper was a fairly complete *résumé* of the whole subject of ballooning, especially for military purposes, while reference was made at some length to the problem of flight. It is well known that Mr. Maxim, of gun fame, has for some years directed his attention to this problem. He has spent nearly £10,000 on experiments, and is confident of ultimate success. Captain Fullerton quoted the following utterance of Mr. Maxim: "If I can rise from the coast of France, sail through the air across the Channel, and drop half a ton of nitro-glycerine upon an English city, I can revolutionize the world. I believe I can do it if I live long enough. If I die, some one will come after me who will be successful if I fail. . . . It can be done as sure as fate. I have spent $45,000 already upon it, and I did not enter upon the work until I was convinced that the idea was practical." This is a sufficiently alarming prediction. But it is not necessary that a flying machine should be employed. Lord Dundonald proposed during the Russian war to send up a balloon, in the car of which was to be carried a few hundredweights of iodide of nitrogen. When the balloon was over Sebastopol, the explosive was to be suffered to fall into the town. It is doubtful if the necessary quantity of iodide of nitrogen could have been got together or handled in any way, seeing that small quantities of it are exploded by tickling them with a feather in laboratory experiments. But in the present day there are, of course, available far more manageable and more powerful explosives. Captain Fullerton believes, as does Mr. Maxim, that the flight problem would be solved at once if only a sufficiently light and powerful motor could be obtained. This is possible; but it is worth while to consider whether such a motor is actually needed, and why it is that flying machines have not yet been made a success.

Any one who has spent a day or two at sea can scarcely have failed to observe the flight methods of gulls. They will follow a steamer for hours together with very little effort, if only the ship is going head to wind, or nearly so. For long periods individual birds will advance at ten miles or fifteen miles an hour without flapping a wing. With a little trouble the observer can easily pick out individual birds in a flock, and he will soon see that some of these fly with much less effort than others. In the structure of the birds there is no difference. If he pursue his investigations, he can scarcely fail to arrive at the conclusion that flight of this kind is not at all a question of power, but of individual skill. Strange as the statement may appear, we have not the smallest hesitation in saying that in order that a gull may fly with very little effort indeed it must be exceedingly skillful, and that certain individuals in every flock are masters of the art of flying, while others are very poor performers indeed. If we take a dead gull, we can have it stuffed, with its wings extended and stiffened with wires. We can put it into precisely the same attitude as that assumed in life, and we can then try to make it fly against a breeze and fail. All the conditions are present save one—volition on the part of the bird. In the same way, we can put a pair of skates on a man, and set him up on them on the ice, but he cannot skate. He has to learn the art, and the more skillful he becomes the less is the muscular effort that skating demands. It would not be impossible to make the similitude of a bird, and to place a man in its body. All the conditions for flight against a breeze might be present, but the man could no more fly than an untaught individual could skate. Birds, no doubt, acquire the art of flying very quickly, because of their inherited gifts in that respect; and the world may yet see men who have acquired the art through the efforts of long generations of flying ancestors. We direct attention to this aspect of the question, because we believe that it is an entire mistake to suppose that any great amount of power is needed. If a flying machine were made on bird-like principles and tried, it would certainly fail, and as certainly we should hear that the failure was due to want of power. It is far more likely that the failure would be due to want of skill. In Eastern fairy tales we are told now and then that men have been transformed into birds. If we suppose that Mr. Maxim was turned into an eagle by some beneficent fairy, he would find very great difficulty in even shuffling over the ground, and flight would be to him an utter impossibility. His energy would no doubt induce him to try his wings, and after some time, if he did not kill or maim himself during the first month, he would perhaps be able to flap about in the air in an ungainly fashion, greatly, no doubt, to the surprise and amusement of the real eagles. In a word, it is not so much the want of means of flying as the want of knowledge of how these means are to be used that stands in the way and prevents mankind from disporting itself in the air.

If we return to our gulls, it will be found that their proceedings well deserve observation. The whole art and mystery of flying against a breeze consists in maintaining an accurate balance. The wings and tail are incessantly in motion, but the motion is very small. A gull will sit on a fifteen miles an hour breeze, and go ahead at ten miles an hour, and it will turn its head and bend its neck and peck at a neighbor in the most unconcerned fashion. In the crowd of gulls, however, one is jostled. The least thing seems sufficient to upset the delicate balance. With a scream of annoyance the bird drops. There is a quick flapping twist, and the gull goes whirling down the wind for a hundred yards or so. Then with an indescribable effort it turns round, head to wind, spreads its pinions, and comes sailing up at thirty miles an hour, without an effort, to resume its place in the crowd looking out for scraps thrown overboard. When the breeze is steady all goes well, but gusts greatly disconcert the gulls. The gusts literally upset them, and the birds scream incessantly with vexation. At last they give up sailing and take to flapping, and then they must be very hungry or scraps very plentiful to keep them in the track of a steamer.

But it will be asked, How is it that a bird can advance against a head wind? Dozens of answers have at various times been given to this question, and pages of formulæ have been devoted to the subject. It cannot be said, however, that a perfectly conclusive answer has yet been supplied. A theory was advanced in our pages by a correspondent some years ago which deserved, we think, far more attention than it received. His explanation is very simple. A bird is, according to it, in precisely the same condition as a fore-and-aft rigged boat sailing close-hauled. In the case of a boat, or, better still, of an ice yacht, the plane of the sails is vertical. But a little reflection will show that much the same result would be got if the plane was not vertical but horizontal. Indeed, cutters when racing sometimes heel so much that the sails, instead of being vertical, stand at an angle of 50° or so with the horizon. It is essential, however, to a boat sailing close-hauled that she shall have a second force besides that of the wind acting on her. This is supplied by the water, which holds her up to the wind. If she did not, in sailor's phrase, get a good hold of the water, she would be pushed sideways before the wind, and would make leeway. In the case of the bird we have a horizontal instead of a vertical sail. The action of the wind on the inclined plane tends to lift it up and drive it back. The equivalent of the water to the boat is supplied in the case of the bird by gravity, its own weight holds it down, and it goes ahead just as a close-hauled boat does. But considerable skill is required to get the best result out of the boat; and the same truth holds good, as we have endeavored to show, of the gull. The theory is ingenious, and in many respects satisfactory; but it does not account for the soaring of birds in a calm. Nor can it without some trouble be made to explain how birds can sail right in the wind's eye, which no boat, not even an ice yacht, can manage.

It is stated that Mr. Maxim has got so far with his motors that he has obtained steam equal to 100 horse power with one square foot of grate, or rather of the equivalent of a grate, for he burns liquid fuel. But the heat generated is so intense that no boiler plate yet made will endure it. We venture to think, however, that he may ultimately find that by working the plane system properly he will need very much less power than now seems to be required. No matter what the machine, however, which ultimately flies, it will be found that the real difficulty will lie in providing the skill necessary for its management. This skill will, of course, be different in kind from that needed by the gull, but it will be none the less necessary and difficult to obtain at first.

Rock Elm.

The growing scarcity of hickory and white ash has prompted wagon builders to look about for substitutes. The makers of common carriages are with them to a certain extent, while the builders of high-class carriage work still adhere pretty generally to the old woods, finding, as yet, nothing that satisfies them where lightness, strength, and elasticity combined are required.

Agricultural implement makers have substituted steel and iron for wood in a large number of places where it was formerly used exclusively. The implement factories are using less than one-half the lumber they did only a few years ago. The light forged or cast steel plow beam has taken the place of the clumsy wooden one of our fathers, that formerly absorbed a large amount of the finest white oak, while the airy spring tooth harrow, entirely of steel, has superseded the old time V-shaped implement that formerly vexed the bosom of Mother Earth.

But while the others have reduced the amount of lumber more or less required in their special lines, the makers of farm and road wagons and heavy trucks are still forced to use nearly the same amount of wood as formerly. White oak, white ash, and hickory have thus far been the chief woods used in wagon construction. Other woods have been used for certain parts in certain localities, for instance, rock maple for bolsters and bed pieces, and locust, birch, elm, and even black walnut, for hubs.

But the three woods named have been the chief reliance for good work, and now that hickory and white ash are becoming so scarce, especially the former, and good, tough white oak is no longer found in great abundance north of the Ohio River, while it is called for for so many other purposes as to greatly enhance its value, substitutes of as nearly equal value as possible, in strength, durability, and elasticity, are eagerly sought after, that may be furnished cheaper than the old stock.

Of all the woods tried, probably rock elm has proved the most satisfactory for many uses in wagon building, where one of the three, oak, ash, or hickory, has heretofore been almost exclusively used. Its elasticity and general toughness should recommend it for axles, bolsters, and reaches. Indeed, it is being sawed for these purposes to a large extent in some sections, a number of the Wisconsin and Michigan hardwood mills having large orders for future sawing.

While it may be true that the bulk of such stock at present goes to the small wagon makers and repair shops, it is also true that some of the largest manufactories in the country are ordering a good deal of rock elm for their season's stock, while the bending factories are taking a large increase over a year ago.

This should be good news to the hardwood men of the extreme North, where the timber is found of the best quality and in greatest abundance. They will be gainers from the fact that it will allow them to clean up another kind of timber when logging a piece of hardwood land. If they can market their rock or gray elm for wagon stock at a fair price, and their soft elm for furniture and hoops, and can add beech to the list of flooring stocks, they will have less to complain of than now.

The elm is a noble tree, in its native habitat, but is by no means so abundant as is thought by many, and while it can be marketed at present at a profit at a much less price than white oak, the general free use of it for wagon and carriage building would, in a few years, greatly enhance its value, by producing a comparative scarcity.—*N. W. Lumberman.*

Agriculture—Flax and Hemp.

Census Bulletin No. 177, relating to the production of flax and hemp in the United States, has been prepared by Mr. John Hyde, special agent in charge of the statistics of agriculture. It shows the total area of land devoted to the cultivation of flax in 1889 to have been 1,318,698 acres, the production of flaxseed 10,250,410 bushels, the production of fiber 241,389 pounds, the amount of flax straw sold or so utilized as to have a determinable value 207,757 tons, and the total value of all flax products $10,436,228. While flaxseed is reported from 31 States, Minnesota, Iowa, South Dakota, and Nebraska produce 80·06 per cent of the total amount, or 1,035,613 bushels in excess of the entire production of the United States at the census of 1880. South Dakota had the largest acreage devoted to flax, and Minnesota the largest production of seed. Of the States containing 1,000 acres or upward in flax, Wisconsin had the highest average yield of flaxseed per acre, 11·42 bushels, and highest average value per acre of all flax products, $13.39. The average yield for the entire country was 7·77 bushels per acre. Throughout the greater portion of the principal flax-seed-producing region flax straw is of little or no value, and much of the so-called fiber is only an inferior quality of tow, used chiefly for upholstery purposes. There are indications, however, of the revival in the United States of a linen industry that will afford a market for fine flax fiber of domestic production, and revive a branch of agriculture that has for many years been almost extinct.

The total area of land devoted to the cultivation of hemp in 1889 was 25,054 acres, and the production of fiber 11,511 tons, valued at $1,102,602 to the producers. This branch of agricultural industry is confined almost exclusively to the State of Kentucky, which produced 93·77 per cent of the total hemp crop of the country. The average yield per acre for the United States is 1,029 pounds, and the average value per acre $44·01, or $95.79 per ton.

Electrical Supplies.

The extent to which the business of furnishing electric light and power supplies has developed within a comparatively brief period is something quite phenomenal, and does not readily receive full appreciation by those not having direct connection with this line of business. Something of its magnitude may be learned by looking over a handsome catalogue of nearly 500 pages recently issued by the Electrical Supply Co., of Chicago, having also factories at Ansonia, Conn. The book is profusely illustrated, and contains so much that has been specially prepared for its pages that the publishers have protected their rights therein by a copyright.