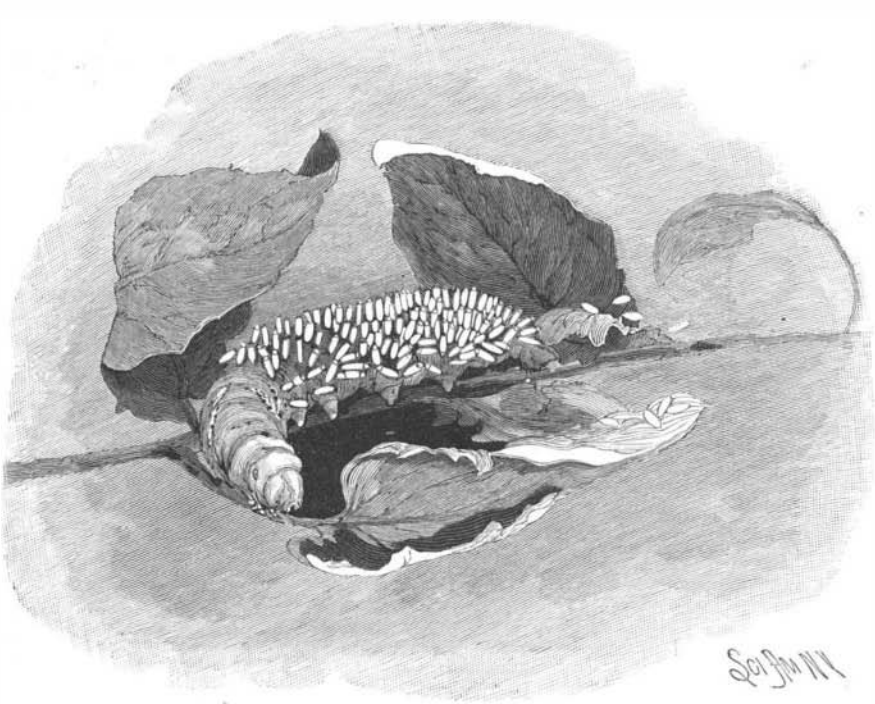
PARASITES ON A CATERPILLAR.

The accompanying illustration represents one of the green sphinx caterpillars so frequently found feeding upon the leaves of wild cherry trees, grapevines, etc. The specimen in question, however, is greatly burdened with a large number of egg-shaped cocoons of a parasitic insect, an ichneumon fly, the cocoons sticking out of the caterpillar's skin the same as bristles on a round brush.

This parasitic insect, on maturing in its shell, bursts the upper end thereof, crawls out, and then sails forth on its own wings. The minute ichneumon flies lay their tiny eggs in the skin of the caterpillar, and from these eggs hatch the larvæ, which live within and get their nourishment from the caterpillar.

The caterpillars infested by these parasites die before attaining maturity; but if healthy caterpillars that are not burdened with the parasitic cocoons be found, it is possible to obtain a pupa or chrysalis which, when properly kept, will change the following year to a moth belonging to the sphinx or hawk moths, which in the morning and evening twilight dart swiftly from flower to flower in search of honey as their food.



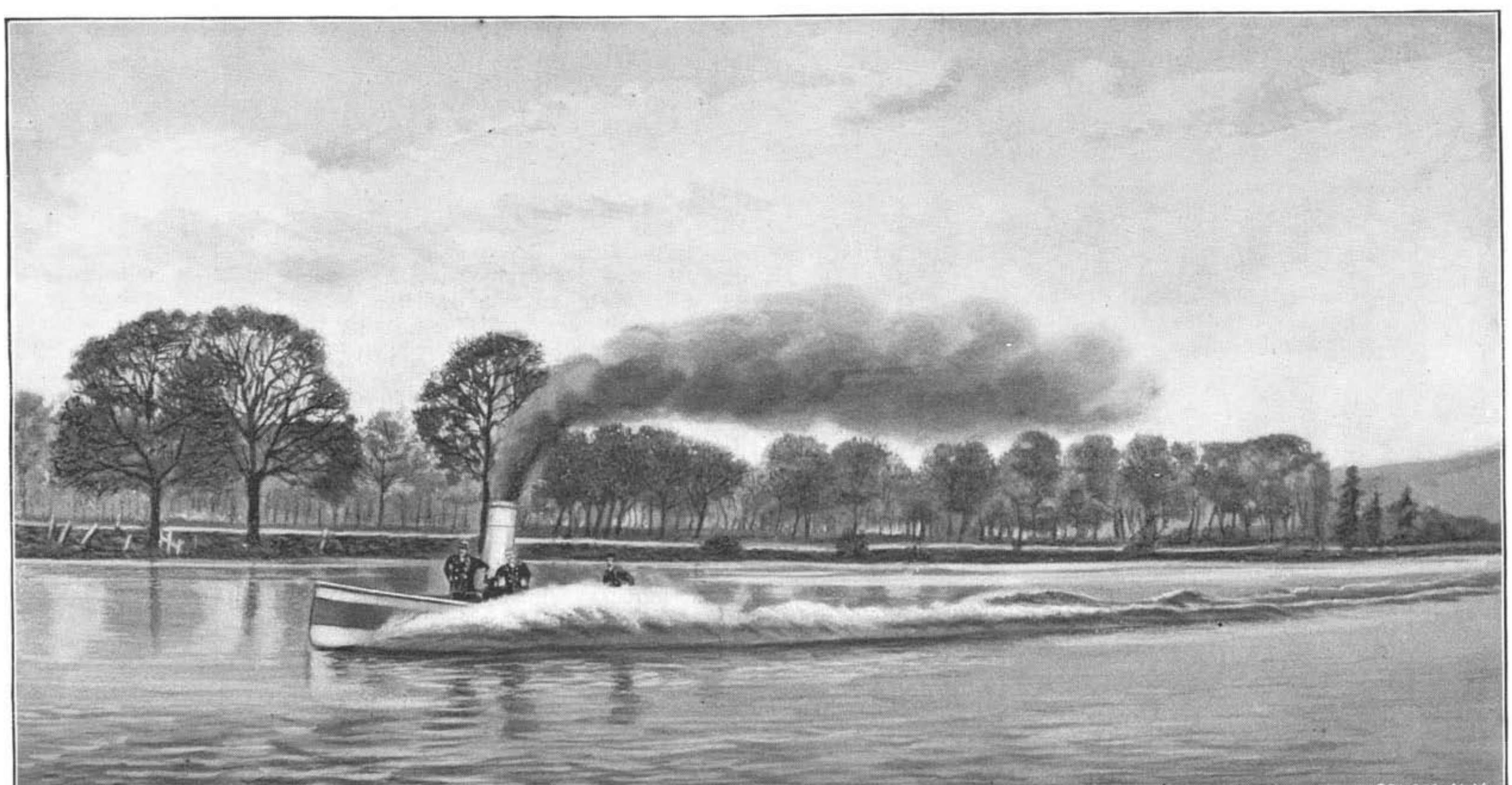
PARASITES ON A CATERPILLAR.

On Manganese Steel.

Manganese steel (13 per cent of manganese) is not magnetic, and of all the alloys of iron it is the one which presents the highest electric resistance. It is the more malleable the more energetically it has been tempered. There is a second allotropic variety which is magnetic. M. Le Chatelier has determined the conditions of the transformation of the two varieties of manganese steel into each other. To convert the non-magnetic into the magnetic metal it is heated to 550 degrees from one to two hours. To convert the magnetic metal into the non-magnetic metal it is heated to 800 degrees and cooled rapidly, so that the inverse change may not be produced between 500 degrees and 600 degrees. The expansion of the two varieties of manganese steel has been found alike which excludes the existence of a change of dimension at the point of transformation. Manganese steel tempered in water on reheating undergoes a contraction of 0·4 mm. in 100 mm.—H. Le Chatelier.

THE HIBERNIA—A FAST STEAM LAUNCH.

Our engraving, for which we are indebted to the Engineer, London, represents the Hibernia, a boat built and engined from the designs of Mr. G. F. G. De Vignes, by Messrs. Simpson & Strickland, at Teddington. It is, we believe, the fastest boat of its size afloat, and a trip in it is an experience. At ordinary speeds the Hibernia behaves like an ordinary boat, cutting her way through the water and leaving a moderate impression in the form of shore waves. With a slight touch of the regulator she leaps forward, and as the speed increases, she gradually sinks a little by the stern, rises a little at the head, until at a certain high speed the bow rises clean out of the water, and the boat flies along at the top of it, throwing a double wall of spray, between which she flies at a speed of about 29 miles an hour with the stream and 26¼ miles against the stream, as measured and remeasured at Mousley. There is but little chance of making these speed trials, and very great risk in making them in this part of the river, for among other difficulties which arise are the objections which owners of house boats urge against having their boats lifted up on the banks and left there. Some idea of the power of this boat, which is the property of Mr. R. H. Lebat, of Hampton Wick, may be gathered from the following statement of dimensions and engine power: The length of the boat is 48 feet 3 inches over all; breadth, 7 feet 3½ inches; draught, 1 foot 4⅛ inches; and depth of propeller below the water line, 2 feet 5 inches. The boiler is of steel, locomotive pattern, with barrel five-sixteenths inch thick, quintuple riveted in longitudinal seams. The engines are two-cylinder, both high pressure, 7⅛ inch diameter, stroke 6 inches, revolutions about 750 per minute up to 1,050 revolutions per minute when doing the highest speed. The propeller has three blades of hammered double shear steel, with carefully prepared surface and knife edge, keyed in a wrought steel boss and accurately balanced. The engines are of small dimensions, except in the wearing and hard working parts, and here the dimensions are very large, and at first glance disproportionately strong. Every detail has been most carefully designed, and carried out with equally careful workmanship and excellent finish. The boat was built for Mr. Lebat chiefly for umpire work at regattas and coaching university crews, and it began coaching for the last races within an hour of steam being first raised. From that time to about three weeks ago the boat ran over 3,300 miles without the touch of a spanner. We have never seen a finer piece of work than these little engines, and Mr. Lebat is to be congratulated on the high quality and performance of both engines and boat.



THE HIBERNIA—A FAST STEAM LAUNCH.

Slate—How it is Mined.

The manner in which slate is mined and cut up for purposes to which it is applied is a process that is known to only a few people in this country, its principal sources being in upper New England and eastern Pennsylvania. It is not taken out of shafts, but it is quarried out of big holes in the earth. Some time ago, when the writer was at Bangor, Pa., he was invited to go down into one of these quarries, about 200 feet deep, and overhand on a rope, but he declined the invitation, as I think most inexperienced persons would do. The slate is blasted out in huge blocks and is hoisted out by steam and turned over to the men who know how to reduce it to the proper size. Huge blocks of it are taken in hand by these workmen, who cut a notch into one end of each piece. Then they take a chisel and a mallet, and they are so skillful in directing their blows that they can split the blocks of slate in almost any way they please. If you watch the slab on which one of them is working, you will see a little hair line running through it, and presently the block will fall apart on either side of this mark. The workman will make this line go straight through the middle, or to either corner, just as he likes. I do not know just how he does it, but he invariably accomplishes what he sets out to do. The smaller pieces thus produced are taken in hand by another set of men, who split them up into sheets of the proper thickness for roofing slate. This they do with a long-bladed instrument about the shape of a putty knife, but many times larger, and if you saw them do it, you would marvel how they got the sheets only inch thick and split it thirty-two times. The usual number of divisions is sixteen. These sheets are taken and cut into squares by machinery.

Wherever there are slate quarries you will find a great many Welshmen, for the best slaters come from Wales. Boys follow the trade of their fathers, and there are whole familes and settlements who know no other means of earning a living.—New York Advertiser.

Aluminum Shoe Nails.

On the late visit of Prince Bismarck to the Emperor, the latter called the attention of the ex-Chancellor to the improvements made in the boots of the Prussian infantry. This consisted in the displacement of the old fashioned steel nails by nails from aluminum, which is much lighter and more durable. The extra weight under the sole of the foot imposed by the heavy nails formerly worn, and the added weight consequent upon the clogging mud in nasty weather, made a great and needless extra amount of muscular expenditure necessary. The new arrangement will permit of longer and better marching, with fresher troops at the end of the day.

[FROM THE MOUNT LOWE ECHO.]

Telescopic Wonders of the Moon.

BY PROF. LEWIS SWIFT.

When we view the moon with a powerful telescope and see her extensive plains and mountain chains, her extensive shorelines and dry ocean beds, her thousands of volcanic craters and their central cones, it is difficult to realize that we are gazing into another world brought by the powers of the telescope, that marvelous instrument, to a distance of a few hundred miles, as it were almost within our grasp. Strange as it may seem, we are more familiar with her mountains than with those of our own world. On this side of the moon, though 240,000 miles away, there is not a mountain whose height has not been measured, nor a crater whose diameter and depth is unknown. The brevity of this paper forbids detailment of the process resorted to accomplish so improbable a feat, though at some future time I may revert to the subject of celestial measurements.

Save a few chains of mountains the scenery of the moon is totally unlike that of the earth.

The naked eye sees the moon flecked with dark patches which by the exercise of fancy become "The Man in the Moon." But, it is needless to say, there is no "man" there nor life of any sort. The dark, naked eye portions were, before the invention of the telescope, looked upon as mares or seas, and names then given them are still retained, as, for instance, Mare Nubium, Mare Crisium, Mare Tranquillitatis, etc. But the telescope has shown beyond doubt that they were once ocean beds, with their shore lines still plainly visible, which, when the moon was young, were lashed by her tidal waves, though now, on this side at least, not a single drop of water may be found. Because there is no waste in nature, and because from lack of contact with other bodies its water could not be conveyed away, the question arises, Whither has it gone? The moon in its cooling from circumference to center has absorbed it all, and a like fate awaits the earth itself in the coming ages.

Her atmosphere too has been absorbed, though she, doubtless, once was thus enveloped. When our planet too shall have cooled to its center, a process slowly going on, it will have absorbed all of its water and air and will thirst for more. Though alike in this, and in both being solid globes, the earth and moon have little or nothing else in common.

To her mountains we have given the names of the mountain systems of our world, as the Alps, the Apennines, the Caucasus, etc., and their scenery consists largely of elevated rings surrounding deep cavities or craters of which the telescope reveals the existence of over one hundred thousand of all sizes, from those of a few rods to the largest (Shickard), 149 miles in diameter, and, in depth, from those of a few yards to the deepest (Newton) over four miles down. On all the earth there is not a true representative of a lunar crater, the nearest approach being that of the Mauna Loa volcano of the Sandwich Islands. The largest of them have, like the seas and mountains, been given names and bear the cognomens of distinguished men of science. The moon, indeed, seems to be a vast cemetery of dead philosophers. We find there Archimides, Aristotle, Copernicus, Gassendi, Herschel, Kepler, Newton, Plato, Ptolemy, Tycho, etc. To describe even the greater ones would transgress the space accorded me. Tycho, best seen when the moon is full, is visible with an opera glass. It is 49 miles in diameter and 3¼ miles deep. From its center rises a conical mountain as high as Mount Lowe. These rings, so prominent a feature of lunar scenery, are often surmounted by cathedral spires or "turrets" sometimes many thousand feet high, which cast long, black, tapering shadows on the flat bottoms of the "craters." In addition to the turrets, many small craters or "craterlets," with yawning chasms between, are seen on the tops of the rings.

Clavius is an enormous ring inclosing 16,500 square miles, in which are several craters, from one of which rises a conical mountain, 24,000 feet in perpendicular height.

The largest of them all, Shickard, so large, in fact, as almost to deserve to be called an immense plain, is 149 miles in diameter, and surrounded with a circular wall, in places ten thousand feet high, which incloses an area of almost twenty thousand square miles, to fill which three hundred Lake Eries would be needed. So immense is it, that were a person to stand at its center, his horizon would be above the ring and he could not be aware of his imprisonment in a well 10,000 feet deep, but would seem to himself to be standing on a level plain. On the flat bottom of this ring twenty-three craterlets have been counted.

Aristarchus is the most brilliant object on the moon and may be seen on the dark side before sunlight has reached it. It was this that Sir William Herschel announced as a volcano in action.

One mountain peak near the moon's limb rears its lofty crest 41,900 feet above the valley below, but this is less high than the highest mountain of the earth, as the depth of the valley must be deducted from its height.

Linne—this little crater has been more discussed than any other, because it is thought to furnish at least one instance of change. Some sixty years ago it was described as being 6½ miles in diameter, and so conspicuous as to be used by two astronomers as fundamental points of the scenery of the moon. In 1866 Schmidt announced that the creater appeared to be under a cloud, and, since then, only an exceedingly small crater is just visible where Linne was. This is the most reliable evidence which can be cited of change in any lunar object.

Lowe Observatory, Echo Mountain, July 20, 1894.

How Postage Stamps are Printed.

Uncle Sam is beginning to print his own postage stamps at the Bureau of Engraving and Printing. The wheels have started, and before many days the machines will be turning out the parallelograms of red, blue, and green paper at a rate to supply the Post Office Department with the required forty million sheets per annum. Each sheet, as furnished to the government, will consist of one hundred stamps. The printing is done on queer looking presses, each of which produces 1,600 stamps a minute, or about 100,000 an hour. Each press has an endless chain that carries four plates, on which the designs of the stamps are engraved. On each plate 400 stamps are represented. The sheets printed from these plates are intended to be cut into quarters eventually, in which shape they will be sold by the Post Office Department. Each plate is carried by the endless chain first under an ink roller, from which it receives a coating of ink of the proper color. Then it passes beneath a pad of canvas, which oscillates so as to rub the ink in. Next it pauses for a moment under the hands of a man who polishes the plate. Finally, a sheet of white paper is laid upon the plate, both pass under a roller, and the sheet comes out 400 printed postage stamps.

The plates revolve in a circle, as it were. More accurately speaking they move around the four sides of a square in a horizontal plane. While one is being inked, another is being rubbed by the canvas, another is being polished and the fourth is passing under the printing roller. The circuit takes about a minute, during which four sheets of 400 stamps each are printed. The most important part of the work, requiring the greatest skill, is the polishing. It is done with the bare hands, no other method being equally efficient. The object is to leave exactly enough ink for a good impression and no more. One girl lays the white paper sheets upon the plates, while another young woman removes them as fast as they are printed and stacks them up in a pile. This process gives the results of handpress work. Half a dozen presses working together, each turning out 100,000 an hour, can produce a good many millions in a day. Three hands are required for each press—the printer, who does the polishing, and two girls. The printer must account for every sheet of blank paper that he receives. The sheets are counted in the wetting division before they are delivered to him. After they are printed they are counted before they are sent to the examining division, where they are counted again. Spoiled sheets are counted as carefully as perfect ones, because they represent money. If lost or stolen, they could be used. On each sheet appears the special mark of the printer who turned it out. An allowance of one and a half per cent is made to him for spoilage. If he exceeds that allowance, he must pay for the extra loss at the actual cost of paper, ink and labor represented. This rule does not apply yet, for the presses are hardly adjusted, and hundreds of sheets have been spoiled in experiments.

If a sheet is lost, it must be traced back to the last person who handled it and that individual will be required to pay face value for the stamps represented. If the person responsible cannot be found, the division which last handled the sheet must pay. No loophole is left for the loss of a single one cent stamp. After being examined, the sheets are counted again and are put between strawboards under a hydraulic press to make them lie flat. Thus they are counted more easily and can be made up into smaller bundles. After undergoing this process they are counted once more and are sent down stairs to be gummed and perforated. For these purposes the Bureau of Engraving has purchased entirely new machinery, and the means employed are more than ordinarily interesting. The method of gumming in particular is a novelty, being wholly different from that utilized hitherto in such work. It is much more rapid and efficient, and before long will doubtless supersede the old plan, which is even now applied to the gumming of cigarette stamps for the internal revenue. The paste is applied to the cigarette stamp by hand with brushes. As fast as they are gummed they are laid sheet by sheet on slatted frames, which are piled in stacks. The stacks are wheeled on trucks into a room, where they are placed in front of electric fans, so that the cool air may dry them. Hot air would accomplish the purpose more quickly, but it would be hard on the workwomen. For this reason the slower process is adopted. The new method will be an immense improvement in every way.

The machines for this purpose have just been set up. There are two of them, exactly alike, and one will do for description. Imagine a wooden box nearly 60 feet long, 4 feet high, and 3 feet wide. From end to end runs what might be taken for the skeleton of a trough. This skeleton projects from the box for a few feet at either extremity. The box is traversed by two endless chains, running side by side two feet apart. Into one end the sheets of printed stamps are fed one by one. As it is fed into the machine each sheet passes under a roller like the roller of a printing press, to which gum made of dextrine is slowly supplied. The sheet takes up a coat of this mucilage on its lower side and is carried on by the endless chain through the long box. The box is a hot air box, being heated by steam pipes. At the other end of it the sheets are delivered at the rate of eighteen a minute. Just one minute is required for a sheet to pass through the box, and it is delivered perfectly dry. The gummed sheets thus delivered are passed over to a long table, where girls pick them up in pairs, and placing the gummed sides together, put them between layers of strawboards. Arranged in this way they are placed under a steam press to flatten them, the mucilage having caused them to curl somewhat. On coming out of the press they are counted again, and now they go to the perforating machines, that make the pin holes by which it is easy to tear the stamps apart.

The perforating machine is an arrangement of little wheels revolving parallel to each other and just far enough apart to make the perforations as one sees them in a sheet of finished stamps fresh bought at the post office. After the perforations have been made across the sheet one way by one machine, the sheet must pass through a second machine for the cross perforations. In the middle of each machine is a knife which cuts the sheet in two, so that the sheet of 400 comes out of machine No. 1 in two sheets of 200 each, and these are divided into four sheets of 100 each by the second perforating machine. It is an old though not well authenticated story that when the British government wished to discover a way to tear stamps apart readily it offered $50,000 for an acceptable suggestion. A poverty stricken but ingenious Englishman proffered the notion of perforating the stamp sheets and received the fortune. The stamps are now done and only remain to be gone over, inspected, counted and tagged in packages of 100 sheets before being sent out. Each package of 100 sheets holds 10,000 stamps, of course. But stay! There are one or two more preliminaries yet. After receiving the perforations, the sheets of one hundred are put under a press to remove the "burrs" around the little holes, otherwise these would greatly increase the thickness of a package. Then they are counted and are placed in steel-clad vaults, from which they are drawn as the Post Office Department may want them. The Bureau of Engraving has not yet begun to furnish stamps to the government, but it is all ready to do so. In response to orders received from the Post Office Department, it will put the stamps up in packages, address them to postmasters who require them and deliver them at the Post Office in Washington for mailing.

The Post Office Department now has an agency at the Bureau of Engraving. When a postmaster wants stamps, he makes out a requisition up onthe department. The latter will communicate with its agent in the bureau, who will draw upon the bureau every day for as many stamps as he requires to fill the orders thus transmitted to him. All this business used to be done in New York City, where the stamp agent received the stamps from the American Bank Note Company in bulk, his business being to put them up in packages and send them off by mail. The inks used for printing the stamps are manufactured at the Bureau of Engraving. The materials are bought in the shape of dry colors and linseed oil. The colors come in the shape of powders. The only stamps turned out thus far are two cent red and the one cent blue. For the former carmine is employed, and for the latter ultramarine. Both colors are "toned" by the admixture of other ingredients—the carmine with Paris white and white lead. Pure carmine would be very costly. Ultramarine is not very expensive, but it is too "strong," in the printer's phrase—that is to say, too dark. It used to be the costliest of colors, being made from the precious lapis lazuli. But in recent years chemists, having analyzed the lapis lazuli, have produced in the laboratory a successful imitation of the color stuff. For making the ink the color powder is combined with linseed oil and ground between rollers. Each printer receives every morning his allowance of ink, and sharp account is kept of every bit used. Uncle Sam will save about $50,000 a year by printing his own postage stamps. Congress has given to the Bureau of Engraving $163,000 for this purpose for the fiscal year beginning July 1. Out of this appropriation some machinery must be bought. The expense used to be $208,000 per annum. Of course the government had nearly all of the required plant ready. About fifty new people have had to be engaged to do the extra work. The plates used by the American Bank Note Company for printing the stamps were the property of the government.—Rene Bache, Phil. Times.