Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

Spiders--Their Habits and Peculiarities.

MESSRS. EDITORS:—Spiders find their way into the tidiest places, an axiom verified by their having found a nook in your columns; before you brush them down, however, allow us to tell "all we know about them." I think a study of the habits and peculiarities of the spider an interesting one, proving both useful and instructive. We find its web counter feited in the fisherman's seine, its spinerets have mechanical counterparts in our threadworks, and we mimic it in bridging rivers and chasms with our suspension bridges—first one frail wire, then another, and so on until the fairy-like structure is completed. To those who fail to see how observations of the habits of these and other insects can prove useful, I will cite the case of the French commander before Utrecht, who, discouraged by the incessant rain and drizzle, was upon the point of abandoning the siege of that city, when Diejonval dissuaded him, saying that he had noticed more than ordinary activity on the part of a spider, which led him to expect a change soon. It turned out as Disjonval predicted, and Utrecht fell! How important an event dangled on the thread of that spider! Mr. Eades, in your third February number, gives an account, in his observations, of a species of flying spiders. I find that Darwin terms them "gossamer spiders," and mentions that while on a ship that was sixty miles from shore, in the direction of a steady though light breeze, vast numbers of these spiders covered the rigging of the ship. Dallas, in his "Animal Kingdom," says of spiders, "that many of them have the faculty of emitting long threads, one end of which floats freely in the air until it meets with some object to which it adheres. By this means spiders form natural bridges by which they pass over brooks and ditches. Some species avail themselves of this power to take flights in the air, where they attain great altitudes." The most casual observer must have noticed how easily the ordinary or geometric spider crosses areas and alleys by means of a single thread having a bunch of a filmy, adhesive nature at its end, to buoy it up until it reaches an opposing object to which it adheres.

Several years ago, while on the "look-out" of one of our large elevators, I noticed a plump spider fall upon the metal roof beneath me, and a wasp darting after it, immediately secured it in a sort of basket formed by its legs, and then flew off with its prize. The question now was, what use has the wasp for the spider? The next season following gave me an opportunity of solving it. Noticing several wasps about some dingy windows in an area, I concluded to watch them, and soon had the satisfaction of seeing a few depart with their game. I traced their destination, and found it to be a number of clay structures under the eaves of a neighboring dwelling. These formations had numerous perforations, about which the wasps busied themselves. Some time after they had abandoned the neighborhood, I gained admittance to the house and removed several of these adobe nests. I opened one of them and found a cell containing an egg or larvæ; the cell beside it was filled with spiders in a torpid state, both great and small, packed closely, with their front legs turned over their backs. The same order of arrangement was observed in the balance of the nest. I came to the conclusion that the spiders were placed there to keep a necessary temperature for the larvæ. I was not satisfied, however, and began a search among various authors, until Darwin, in his "Researches," set me right, by describing "certain wasp-like insects which construct in the corners of verandahs, clay cells for their larvæ. These cells they stuff full of half-dead spiders and caterpillers, which they seem wonderfully to know how to sting to that degree as to leave them paralyzed until their eggs are hatched, and the larvæ feed on this horrid mass of powerless, half-killed victims." I might go on and relate instances of the courage and ingenuity of the garden spider, but a fear that I am encroaching on your valuable space forbids it. I will close by giving another instance of the usefulness of observations of insect life. A Scotch mathematician, in measuring the angles of a bee cell, discovered an error in a table of logarithms "sufficiently great to have occasioned the loss of a ship at sea, whose captain happened to use a copy of the same logarithmic tables for calculating his longitude." H. W. BLEYER.

Buffalo, N. Y.

More about Suction Pumps.

MESSRS. EDITORS:—On page 67, Vol. XVIII., your correspondent endeavors to place some strictures upon my statements in a former communication. He says, that "the pressure on any valve is just the same when in the pump at work as when out of the pump—that is, equal on all sides. If this were so, the valve would never move at all; for, as in the case of any other body, there being an equilibrium of the forces acting upon it, it would necessarily remain at rest. But I maintain that it is pressed downward with just the force required to raise it, and that the pressure is proportional to the area of the valve (or piston, if that be considered), multiplied by its perpendicular hight above the surface of the water in the well. As to the water being sustained, he cannot note my language very carefully, or else he would perceive that I do not say what force sustains the water in the "feed pipe," but only that there is pressure on the valves, and that the water is sustained. But I will now say that the water is both sustained and raised through the agency of the valves, for without them neither would be done. I will endeavor also to show the amount of pressure on any valve. First, the pressure on the surface of water exposed to the atmosphere is the weight of the atmosphere, an amount varying slightly with atmospheric changes, and considerably with the hight or distance of such surface from the center of the earth, and ascertained to be fifteen pounds per square inch at the level of the sea.

Suppose a straight tube of sufficient length, open at both ends, fixed perpendicularly in a well, with its lower end below the surface of the water, and that a piston within it, and movable through its whole length, be placed exactly at the surface of the water, and then moved upward. As the piston is raised, it carries with it, and above it, the weight of the atmosphere on its upper surface, which weight would otherwise rest on the surface of the water inside the tube; and this weight being removed, the pressure of the atmosphere on the water outside the tube forces it to follow the piston upwards. Now, suppose the area of the piston to be one square inch, and the hight to which water can be raised in this way to be 33 feet, or 396 inches, then it is plain, that, in the beginning, or when the lower surface of the piston is level with the surface of the water outside the tube, the upward pressure of the water upon the piston is just 15 pounds. When the piston is 33 feet above the surface, the atmospheric pressure sustains a column of water at the same hight, or 3 cubic inches of water, while it imparts no pressure to the lower surface of the piston, inasmuch as the water will follow it no further. From this it will also be seen, that, for every inch the piston rises, the pressure on its lower surface is diminished by $\frac{1}{396}$ of 15 pounds. Hence, the aggregate pressure on the piston, at any point, may be found by taking the constant downward pressure of 15 pounds (15 pounds to every square inch of surface in any other case), and subtracting therefrom such a fractional part of 15 pounds as its hight lacks of 33 feet; in other words, the sum of these two opposite effects of atmospheric pressure is a downward pressure, varying exactly as its hight. The same is true of the valves, valve-boxes, and pistons of suction pumps, applicable to the upper valve when ascending, and to the lower one when the upper one is descending, or to either when closed; and the amount of pressure obtained by this rule, plus the force necessary to overcome the inertia of the mass to be moved, together with the friction of the water, and that of the piston against the sides of the tube, will be the force to be applied to the piston in order to move it upwards and raise the water to its own hight.

As to your correspondent's criticism on the word "generally," I would say that the word was used as the word *general* is, when we speak of a general rule, meaning one of general application, or true in all cases to which it is applicable.

Now for the friction question. The friction of the water, other things being equal, will be in proportion to the surface of the containing solids passed over by it. Suppose two tubes, one having an area of cross section of one square inch, and the other of four square inches, with equal pumps attached. If the water in the larger tube must move five inches to deliver a certain quantity of water, that in the smaller must move four times as far, or twenty inches, to deliver an equal quantity. The surface passed over in the first case is the inside of a tube 5 inches in length, whose area of cross section is four square inches. The surface passed over in the second case is the inside of a tube 20 inches long, with an area of cross section of one square inch. The first is $\sqrt{\frac{4}{.07958}}\times5=\sqrt{\frac{100}{.07958}}$ square inches for the larger tube. The second is $\sqrt{\frac{1}{.07958}}\times20=\sqrt{\frac{400}{.07958}}$ square inches for the smaller tube.

These, it will be seen, are to each other as $\sqrt{1}$ to $\sqrt{4}$, or 1:2, thus proving the amount of friction from passing over a larger surface, to be twice as great in the smaller as in the larger tube. It will be seen further, from the above, that the amount of friction from the cause named varies inversely as the square roots of the areas of the cross sections of the tubes. Hence, it is easy to see that the relative size of pumps and feed pipes is a question of considerable importance on account of the friction of the water, especially where it is to be carried over long distances, and raised to considerable hights.

Oneida, N. Y. M. N. HORTON.

Carbonic Acid Gas in Wells.

MESSRS. EDITORS:—To relieve wells or other vertical excavations of damp, or carbonic acid gas, or the smoke of gunpowder in blasting, make a hoop of any flexible material of sufficient weight (a grape vine answers well), nearly the size of the excavation. With a coarse blanket or any other strong cloth make a bag five or six feet long; sew the hoop in the open end, so as to keep the bag distended. Tie a rope across the hoop, and attach to the center of it a long rope, which will reach to the bottom of the well. Hold the bag so that the distended or open end will descend first. Let it drop, and it immediately becomes inflated with air, which is carried to the bottom, and displaces the impure air. A few repetitions of the fall of the bag render the air at the bottom entirely pure. J. M. W.

Seguin, Texas.

Ships' Pumps Done Away With.

MESSRS. EDITORS:—I saw in your issue of Feb. 15th an article headed "Ships' Pumps Done Away With." I used something like it in 1862, on the lower Ohio, by boring a hole in the bottom of a flatboat and inserting a gooseneck pipe. As long as the boat was under headway the water would run out, but as soon as the headway stopped the water would come back. I thought at the time that a boat in a four or five mile current would be kept free of water in this way. It was no invention of mine, as I heard it spoken of fifteen years ago, and it is an old story to flatboat and steamboat men of the West. A STEAMBOAT MAN.

Transmission of Power for Long Distances.

MESSRS. EDITORS:—On pages 98 and 99 of Vol. XVII, there is an article from your special correspondent giving a description of a method used at Schaffhausen, for transmitting water power for a very long distance, and, as he remarks, it is a matter of great importance. The article has doubtless been read by thousands with as much interest as I felt in perusing it. The plan he describes has, however, been tried in this country with but indifferent success. In attempting to convey power two hundred feet, I first tried a hemp rope one and one-eighth inches diameter, then a manilla rope, and lastly a hide rope, all with the same success; they all three wore out in about a year, when they wore off the strands on the inside of the rope. The continual working and bending seemed to cut the inside strands
to be comparatively perfect. An attempt to splice them entirely failed.

Now will wire rope be any more durable? In my experiment the pulleys used were six feet in diameter making one hundred revolutions. It is not always practical to support a shaft for a long distance. I have had many years' experience in manufacturing, using both water and steam as power, yet I have not been able to arrive at a fixed conclusion which is the best means of conveying power for long distances—shafting or belts—and I find a great diversity of opinion among mechanics on this subject. M. J. W.

Champlain, N. Y.

Polygons.

MESSRS. EDITORS:—One of your correspondents, page 410, Vol. XVII., wants a theoretical demonstration that the side of the regular heptagon inscribed in a circle is equal to half the side of the inscribed equilateral triangle. This demonstration cannot be given, as it is not strictly true. For the radius=1, the side of the heptagon is equal to twice the sine of one fourteenth of 360°, or twice the sine of 25° 42′ 51″, which is equal to 0·4339; half the side of the triangle is equal to $\frac{1}{2}\sqrt{3}$, or 0·4335; the difference of these two numbers is so small that in common practice one can be used for the other, but they are not absolutely equal, and hence the impossibility of demonstrating this equality. Only in cases where the equality is absolute, demonstrations are possible. There are many other rules for constructing polygons of an odd number of sides, but as they are only approximate, no demonstration can be given. So is one-third of the diameter only a little smaller than the polygon of nine sides; seven twelfths of the radius very little larger than that of eleven sides; one-quarter of the radius nearly equal to that of twenty-five sides, etc.* P. H. VANDER WEYDE, M. D.

Hardening Mill Picks.

MESSRS. EDITORS:—On page 103, current volume, in publishing my reply to "L. D. M.," on hardening mill picks, you make me say, "cool the picks in the bath, and drawn to temper." It should be "draw no temper." The salt gives hardness, and the other ingredients toughness to the steel; and they will not break, if they are left without drawing the temper. S. H. B.

A Formidable Prussian Iron-Clad.

About three years ago the Turkish Government contracted with Mr. Reed, of the Thames Iron Works, in London, to build an iron-clad, larger, stronger, faster, and more powerful, than any vessel of her kind. The work was begun, but after a while the Turkish remittances failed, and Mr. Reed was obliged to look about for another purchaser of his vessel. The Prussian Government quickly accepted the offer, and the work went on to completion.

The vessel has just been finished at London. She is called the *King William*, is of 6,000 tuns burden, draws 26 feet of water, and carries 8-inch armor, with a battery of 26 300-pounders, all of Krupp's steel, all breech-loaders, and capable, it is said, of being fired with 75-pound charges as often as twice in a minute. Her engines can be worked up to 7,000-horse power, and she can make fourteen knots an hour.

She is constructed on what is called the longitudinal system, that is, a series of most powerful wrought-iron girders, or frames, laid at a distance of seven feet apart, and passing along her completely from stem to stern. Between these the wrought-iron ribs are bolted, below the water line, at intervals of four feet apart, but above it, and behind the armor they are bolted as close as to within two feet of each other. Within both frames and ribs comes another iron skin an inch thick, so as to literally make a double ship, the inner one being four and a half feet apart from the outer.

Side passages, or wings as they are called, running the whole length of the structure, continue this double form up to the main deck. The inner side of these wings form the sides of the coal bunkers, so that even were it possible for a shot to pass through the armored sides of the *King William*, it would still have to penetrate the iron coal bunkers and pass through eight feet of coal before it could do any mischief to the fighting crew of the ship. She is ship rigged and will carry a crew of 700 men. She cost $2,000,000.

PEACHES WITHOUT STONES.—An agriculturist has, it is said, tried with success the following method of making peaches grow without stones: "Turn the tops of the trees down, cut off the ends, stick them into the ground, and fasten them so with stakes; in a year or two those tops will take root, and when well rooted cut off the branches connecting these reversed and rooted branches with the tree proper, and this reversed peach tree will produce fine peaches without stones" The same experiment may be tried with plums, cherries, and currants.