

## THE TAIL OF A TADPOLE.

Is any one partial to bull-frogs? can any one but the gournand who loves their hind legs served up in white sauce, find any interest in such unwieldy, unmusical, and lopping animals, who have not even the toad's redeeming feature of wearing a jewel in their heads? Yes! some can. The naturalist who loves to investigate all that God has made, and who regards none of his works as "common or unclean."

If to the common mind, frogs are uninteresting, how much more so must Froggy junior, the little black and wriggling tadpole be! What can be found in him worth studying? Science answers that his very tail is a world of mystery and full of wonders as a conjuror's box. Listen how it is described by that loving naturalist and pleasant writer, C. H. Lewes, in the first number of the new English periodical called *Once a Week*:—

A blade of grass is a world of mystery, would men observingly distill it out. My erudite friend, Gerunds, glancing round my workroom, arrested his contemptuous eye on a vase abounding in tadpoles, and asked me with a sniffing superiority, "Do you really mean to say that you find any interest in these little beasts?"

"As much as you find in *Elzevirs*," I energetically answered.

"H'm!" grunted Gerunds.

"Very absurd, isn't it? But we have all our hobbies. I can pass a bookstall on which I perceive that the ignorance of the bookseller permits him to exhibit an edition of *Persius* among the rubbish at 'one shilling each.' The sight gives me no thrill—it does not even slacken my rapid pace. But I can't so easily pass a pond in which I see a shoal of tadpoles swimming about, as ignorant of their own value, as the bookseller is of *Persius*. I may walk on, but the sight has sent a slight electric shock through me. Why, sir, there is more to me in the tail of one of these tadpoles than in all the poems of that obscure and dreary *Persius*. But I won't thrash your Jew unless you thrash mine."

"Why what on earth can you do with the tail?"

"Do with it? Study it, experiment on it, put it under the microscope, and day by day watch the growth of its various parts. At first it is little but a mass of cells. Then I observe some of these cells assuming a well-known shape, and forming rudimentary blood-vessels. I also observe some other cells changing into blood-cells. Then the trace of muscles becomes visible. These grow and grow, and the pigment-cells, which give their color to the tail, assume fantastic shapes."

"Very interesting, I dare say."

"You don't seem to think so, by your tone. But look in this vase: here you see several tadpoles with the most apologetic of tails—mere stumps, in fact. I cut them off nine days ago."

"Will they grow again?"

"Perfectly; because, although the frog dispenses with a tail, and gradually loses it by a process of resorption as he reaches the frog form, the tadpole needs his tail to swim with; and nature kindly supplies any accident that may deprive him of it."

"Yes, yes," added Gerunds, glad to feel himself once more in the region of things familiarly known: "just like the lobster, or the crab, you know. They tear off their legs and arms in the most reckless manner, yet always grow them again."

"And would you like to know what has become of these tails?"

"Arn't they dead?"

"Not at all. 'Alive and kicking.'"

"Alive after nine days? Oh! oh!"

"Here they are in this glass. It is exactly nine days since they were cut off, and I have been watching them daily under the microscope. I assure you that I have seen them grow, not larger, indeed, but develop more and more, muscle-fibers appearing where no trace of fiber existed, and a cicatrice forming at the cut end."

"Come, now, you are trying my gullibility!"

"I am perfectly serious. The discovery is none of mine. It was made this time last year by M. Vulpian in Paris, and I have only waited for the tadpole season to repeat the observations. He says that the tails constantly lived many days—as many as eighteen on one occasion; but I have never kept mine alive more than eleven. He says, moreover, that they not only grow, as I have said, but manifest sensibility, for they twist about with a rapid swimming movement when irritated. I

have not seen this, but M. Vulpian is too experienced a physiologist to have been mistaken; and with regard to the growth of the tails, his observations are all the more trustworthy because he daily made drawings of the aspect presented by the tails, and could thus compare the progress made."

"Well, but I say, how the deuce could they live when separated from the body? our arms or legs don't live; the lobsters legs don't live."

"Quite true; but in these cases we have limbs of complex organization, which require a complex apparatus for their maintenance; they must have blood, the blood must circulate, the blood must be oxygenated—"

"Stop, stop; I don't want to understand why our arms can't live apart from our bodies. They don't. The fact is enough for me. I want to know why the tail of tadpole can live apart from the body."

"It can. Is not the fact enough for you in that case also? Well, I was going to tell you reason. The tail will only live apart from the body so long as it retains its early immature form; that is to say, so long as it has not become highly organized. If you cut it off from a tadpole which is old enough to have lost its external gills a week or more, the tail will not live more than three or four days. And every tail will die as soon as it reaches the point in its development which requires the circulation of the blood as a necessary condition."

"But where does it get food?"

"That is more than I can say. I don't know that it wants food. The power of abstinence possessed by reptiles is amazing. I was reading the other day an account of a reptile which had been kept in the Boston Museum for eight-and-twenty months without any food, except such as it might have found in the small quantity of dirty water in which it was kept."

"Really I begin to think there is more in these little beasts than I suspected. But you see it requires a deal of study to get at these things."

"Not more than to get at any of the other open secrets of nature. But since you are interested, look at these tails as the tadpoles come bobbing against the side of the glass. Do you see how they are covered with little white spots?"

"No."

"Look closer. All over the tail there are tiny cotton-like spots. Take a lens if your unaccustomed eye isn't sharp enough. There, now you see them."

"Yes; I see a sort of fluff scattered about."

"That fluff is an immense colony of parasites. Let us place the tadpole under the microscope, and you will see each spot turn out a multitude of elegant and active animals, having bodies not unlike a crystal goblet supported on an extremely long and flexible stem, and having round their rim or mouth a range of long delicate hairs, the incessant motion of which gives a wheel-like aspect, and makes an eddy in the water which brings food to the animal."

"Upon my word this is really interesting! How active they are! How they shrink up, and then, unwinding their twisted stems, expand again! What is the name of this thing?"

"*Vorticella*. It may be found growing on water fleas, plant, decayed wood, or these tadpoles. People who study the animalcules are very fond of this *Vorticella*."

"Well I never could have believed such a patch of fluff could turn out a sight like this: I could watch it for an hour. But what are these small yellowish things sticking on the side of parasites?"

"These, my dear Gerunds, are also parasites."

"What, parasites living on parasites?"

"Why not? Nature is economical. Don't you live on beef and mutton and fish? Don't these beefs, muttens, and fish live on vegetables and animals? don't these vegetables and animals live on other organic matters? Eat and be eaten is one law; life and let live is another."

Gerunds remained thoughtful; then he screwed up one side of his face into frightful contortions, as with the eye of the other he resumed his observations of the *Vorticella*. I was called away by a visitor to whom I didn't care to show my tadpoles, because to have shown them would have been to forfeit his esteem for ever. He doesn't think very highly of me as it is, but has a misty idea that I occupy myself with science; and as science is respectable and respected—our Prince Consort and endless bishops patronizing the British Association for

the Advancement of Science—the misty idea that after all I may not be an idiot, keeps his contempt in abeyance. But where he once to enter my work-room and see its bottles, its instruments, its preparations, and above all, the tadpoles, I should never taste his champagne and claret again.

## AMERICAN MOWING-MACHINES IN ENGLAND.

While the armies of France are winning battles on the plains of Italy, our American inventors are achieving more noble victories on the plains of Great Britain. The *Liverpool Mercury* informs us that a recent trial took place at the farm of Jonathan Bell, of Blakelow Hall, with one of "Wood's American Combined Reapers and Mowers," and its performance gave the highest satisfaction to a large concourse of gentlemen who had assembled to witness its operations. The *Mercury* says:—

"The place selected for the trial was a piece of rye-grass, mixed with clover, of fair average growth. The experiment was highly successful, and many of the gentlemen present expressed themselves in terms of commendation as to the admirable manner in which the work had been performed. It ought to be stated that the unevenness of the ground presented what might be considered as obstacles to the machine; but these were overcome without any difficulty. In fact, the test being more severe than it would have been under ordinary circumstances, brought the peculiar advantages of the new principle more prominently into view. By an easy and simple adjustment, the machine may be employed in reaping corn and cutting grass or clover, combining all these powers in a most efficient manner. Two other machines were exhibited at the same time—one for tedding or spreading hay, and the other a horse-rake, for collecting it and saving it from damage by exposure. These apparatuses are useful accompaniments to the mowing-machine previously described, all of which will, no doubt, as they become more generally known, be extensively used in agricultural operations. Towards the close of the day, the mowing-machine was tried in another field on Mr. Bell's farm, and with even greater success than in the first instance, from the more favorable character of the ground. Several of the gentlemen present, accompanied by Mr. Bell, inspected his farm, which is being fitted-up on the model principle, with new machinery and other appliances for conducting agricultural operations on an enlarged scale. We may add that Mr. Bell himself bore testimony to the advantages of the reaping and mowing-machine, which had been so successfully tested on his grounds."

The term *corn*, in the above extract, is used for oats, the name by which this grain is most commonly known in Great Britain. The horse-rake and hay-spreading machines, which accompanied the mower, were also American inventions, as we understand it.

We also learn from the Glasgow (Scotland) *Morning Journal*, of June 11, that a contest with one of Wood's machines, and one made at Stirling, in that country, by a Mr. Gardner, took place near Glasgow on the day previous to the above date, and which ended in the complete success of the American mower. There were several judges present from an Agricultural Fair then being held in Glasgow, and there was a great crowd of very intelligent farmers present. The *Journal* says:—

"Two fields of grass were placed at the disposal of the judges, and Wood's machine was first set to work upon a slightly hilly field of somewhat light grass. It was drawn by two horses, and without any 'swath' being cut, the machine was driven right to the top of the field, returned, and cut out a small square across the field. In crossing, the side-furrows were very deep, yet the machine worked without the slightest difficulty, making a clean and satisfactory cut."

Mr. Gardner's machine was next set to work in the same field; it was likewise drawn by two horses, and made a very creditable appearance, although it was quite evident at the first start that Wood's machine had an immense advantage by being provided with a guiding-pole, and from the complete arrangements for lowering and raising the cutters and working the machine. But the difference became more apparent when the two machines were set to work upon another field of remarkably heavy grass. There Wood's machine did even better work than upon the lighter grass, cutting close and regular, being easy of draft, and, after the horses became accustomed to it, was driven and worked by one

person only. At the finish, a feat was accomplished which astonished every one, by cutting a breadth of laid and trampled grass in the most perfect manner. The superiority of Wood's machine over Gardner's was very marked; indeed, the work of the latter upon the heavy grass was inferior, while the work to the horses was most severe.

The judges now declared themselves quite satisfied. They highly commended Wood's machine, and awarded it a silver medal. Mr. Gardner's machine was commended. Although special reference was not made to time, the agents for Wood's machine guarantee it to cut a minimum of one acre per hour.

It will be interesting to know that the successful machine was worked by a Mr. Herman, who arrived from the United States only a few days ago, and who elicited the praise of all present for the cool and masterly manner in which he managed it."

IMPROVEMENT IN STEAM-BOILERS.

We find the following article in the Portland (Me.) Advertiser, of July 7; and as it has reference to the invention of Mr. F. B. Blanchard, which we illustrated and explained on page 412, Volume XIII., of the SCIENTIFIC AMERICAN, we transfer it to our own paper for the benefit of our readers, as it is a practical test of the value of the improvement, and thoroughly confirms the opinion we expressed nearly a year ago:—

"We have had running about in our harbor, for a few days past, a steam-tug on a novel plan, wherein the use of a chimney is dispensed with entirely while running, and the heat that usually passes off from the top of the smoke-pipe, oftentimes at so high a temperature as to ignite the gases, is made available to do duty in the engine.

A Board of Engineers was called by the proprietor of the tug, Captain Willard, and Mr. Blanchard, the inventor of the improvement, for the purpose of ascertaining the exact saving by this invention over all our old boilers, in order to settle the amount to be paid by Capt. Willard for the use thereof, and to test carefully the whole matter for the benefit of the public; and, for the information of all interested in this subject, we here-with annex the certificate of that Board of Engineers:—

"We, the undersigned, by request of Capt. Willard and Mr. F. B. Blanchard, and by a desire of our own to ascertain the value of Mr. Blanchard's invention, went on the steam-tug Tiger for the purpose of experimenting with the boiler, both upon the old plan and with Mr. Blanchard's improvements, it having been so constructed that it could be operated both ways.

On Monday last we experimented upon the old plan, carefully noting every particular, height of water and head of steam, both at the commencement and the termination, quantity of fuel used and quantity left in the furnace at the conclusion. Commencing our experiment with the water at the boiling point, then noting the time consumed, distance run and revolutions made, the following is the summing-up of the results:—

Coal used to build fire and get up steam at the wharf, lbs.....	1,071
Charged furnace with coal used in running the trip, lbs.....	1,008
	2,079
Deduct coal saved from furnace, lbs.....	500
Deduct quantity supposed to be consumed before boat left the wharf, in getting up steam, lbs.....	200
	700
	1,379

On Thursday, the boiler was used with Mr. Blanchard's improvements, and everything made to correspond in getting up steam before starting from the wharf as in the former experiment:—

Coal used to build fire and get up steam at the wharf, lbs.....	1,071
Charged furnace with coal used in running the trip, lbs.....	126
	1,197
Deduct coal saved from furnace, lbs.....	311
Do. quantity consumed, as before, lbs.....	200
	511
	686

This statement is made in a simple form, so that any one using a steam-boiler, or interested in the saving of fuel, may readily understand it, and shows the quantity

of fuel saved by Blanchard's improvement over the best made boilers to be the amount of over one-half.

The time of running, distance, number of revolutions, head of steam, height of water, &c., were all made fully equal in Mr. Blanchard's experiment to the one made on Monday.

The engine was worked at full stroke without any cut-off, and the expansive power of super-headed steam being much greater than ordinary steam, we have not the least hesitation in stating that, had the test been made with an expansive-working engine, Mr. Blanchard would have shown a far greater gain than even the remarkable results above proved.

Signed:—JOHN SPARROW, Superintendent of Portland Company's Works; PHINEAS BARNES, JR., of Portland Co.'s Works; J. JOHNSON, Chief-engineer of Forest City; IRA WINN, Machinist and Engineer; THOMAS FAGEN, Eng'r of Portland Sugar House; JOS. L. WINSLOW, JR., of Winslow's Machine Shop; WM. K. RHODES, Eng'r of Winslow's Machine Shop; CHAS. W. CAHOON and WM. WILLARD."

An advertisement of Mr. Blanchard may be found in our advertising columns. \*

BOILER-IRON.

The explosion of the boiler of the steamer Bay State, which recently took place on the East river, is attributed to an unseen flaw in the metal, and the blame of the explosion is thus to be fastened upon something which could not be detected when the boiler was made. But is this really the case? If the defective plate stood the hydraulic test of the Inspector, it should have stood the legal pressure of the steam, which is lower than the Inspector's pressure test. We throw out this remark because it is a conclusion derivable from all the circumstances of the case.

It has been stated by a correspondent of the Daily News, under the signature of "Engineer," that some dealers in boiler-iron place fraudulent stamps on poorer qualities, and sell them for the best. In regard to this statement, the Courier and Enquirer says:—

"When the laws providing for the inspection of steam-boat boilers were passed, it was also provided that the materials of which the boilers were constructed should likewise be inspected. The intention of our legislators was that every means should be resorted to for rendering steamboat-traveling as safe as possible. It would appear, however, that though these inspectors may discharge their duties faithfully, yet the public can be cheated out of the benefits to be derived from their doing so. It is now said that iron which has been inspected and stamped, is sometimes re-stamped—that iron of a second quality is stamped as the best boiler-iron."

Three leading firms in this city, who deal in boiler-iron, have come out in a card, indignantly disclaiming such a practice for themselves, and demand to have the matter most thoroughly investigated. If the correspondent of the Daily News knows the firms who fraudulently stamp boiler-iron, it is very easy for him to point them out, and he ought to do it. Viewing this question from our position, it seems to us that the public discussion about fraudulent stamps on boiler-iron has been initiated for the purpose of directing public attention from the true cause of the explosion. We may be mistaken in this view, but from the facts which have been elicited thus far, we think our conclusion a very reasonable one.

THE MOTHER MOLDS THE MAN:—That it is the mother who molds the man, is a sentiment beautifully illustrated by the following recorded observation of a shrewd writer: "When I lived among the Choctaw Indians, I held a consultation with one of their chiefs respecting the successive stages of their progress in the arts of civilized life; and among other things, he informed that at their start they fell into a great mistake—they only sent boys to school. These boys came home intelligent men, but they married uneducated and uncivilized wives—and the uniform result was, their children were all like their mothers. The father soon lost all his interest in both wife and children. 'And now,' said he, 'if we would educate but one class of our children, we should choose the girls, for when they become mothers they educate their sons.' This is the point, and it is true. No nation can become fully enlightened, when mothers are not in a good degree qualified to discharge the duties of the home-work of education."

EXPERIMENTS WITH TURBINE WHEELS.

MESSRS. EDITORS:—The experiments upon turbine water-wheels, directed by the Watering Committee, will be commenced on the first of August. Models must be constructed to discharge about 200 cubic feet per minute, and work under a head and fall of from 6 to 12 feet. A drawing must accompany each model, and a description of the peculiarities of the wheel.

These experiments are undertaken to determine the wheel that will be best adapted (all things considered) for our "Fairmount Works." Two of the wheels approved of will be ordered at once. They will be of about 100 horse-power each, and intended to work under a head of from 6 to 12 feet, varying with the tide. Each wheel will be required to work two double-acting pumps, 18 inches diameter of cylinder, and 6 feet stroke, making from 10 to 16 strokes per minute, and pumping the water into a reservoir 115 feet above the surface of the dam.

H. P. M. BIRKENBINE, Chief-engineer. Philadelphia, July 16, 1859.

[This letter came to hand after we had gone to press last week; but we suppose that, although the experiments are to be commenced on the first of next month, they may be continued for a considerable period of time afterwards with the same arrangements. Mr. Birkenbine appears to be favorably impressed with the performance of the turbine over the breast-wheels which have been heretofore used at Fairmount. We suppose this conclusion is founded on the comparative action of the turbine which they now have, and the old wheels. It will afford us pleasure to hear the results of those experiments.—Eds.

STEAM CARRIAGES.

MESSRS. EDITORS:—In your number for July 16, is a notice entitled, "Lee & Larned's Self-propelling Steam Fire-engine," which concludes as follows: "We think that this journey shows that there is an engine suitable for common roads, and perhaps a more extended application than fire-engine purposes may be found for Messrs. Lee & Larned's build of steam carriages." I wish to state that I am the inventor of all but the boiler and pumps of the two engines built for New York City, and illustrated on page 89, Volume XIV., SCIENTIFIC AMERICAN. I made the outlines from which those illustrations were engraved, and the working drawings from which the machines were built; and I had no assistance of any engineer in determining the proportions, although I earnestly requested leave and means to get the advice of locomotive-builders. The engine mentioned in your paper of the 16th, I am informed, is on the same plan, except that it is made narrower by narrowing the frame behind, so that, while there is room forward for the boiler, the wheels and engines are brought nearer together. This modification I advised at first, and made a drawing to show it.

Messrs. Lee & Larned have no right to build steam carriages on this plan, nor have they a right to use it for fire-engines, other than the two built for New York. They claim a right, which claim they found on an agreement which they have forfeited, and I have notified them that I intend to apply for a patent as soon as my present experiment is completed, and that they should not use my invention.

J. R. FISHER.

Paterson, N. J., July 16, 1859.

["Honor to whom honor is due."—Eds.

WASHING HORSES LEGS.—It is quite a common custom for carmen and hostlers to "founder" noble horses, by the erroneous practice of dashing of cold water on their legs when they are dirty. In regard to this practice Sir George Stephens the eminent veterinary surgeon says, "Wherever it is necessary to wash horses' legs, do it the morning. Most grooms, acting on a different principle, was them as soon as the animal comes in. I am convinced this is a bad practice. When the roads are dirty, and the weather wet, and the legs already soaked, washing can do no harm; but to deluge the legs with water the moment a horse enters the yard, heated with exercise, is to my mind, as unnatural and absurd as to jump into a shower-bath after playing an hour at cricket. My plan is, rubbing down with straw and a dry brush, and the next morning wash as clean as soap and water can make them, Pick and wash the soles as soon as the horse comes in."