THE MUSCULAR POWER OF INSECTS.

The muscular system of insects is in no wise inferior in power to that of vertebrate animals, and it may even be asserted that it is capable of developing an infinitely greater amount of force. Observation has demonstrated this most fully. Who has not seen the ant dragging along prey ten or twenty times larger than itself? Who has not watched the motions of certain small flies as they unwearyingly poised for hours around the chandeliers and other objects in our houses? And who has not ascertained that the horse-fly follows and beats the best horses running at full speed?

In order to render the fact more striking, M. Felix Plateau has undertaken an ingenious series of experiments of the most demonstrative character. He has caused small wagons filled with weights to be drawn by cockchafers harnessed to them in the manner of oxen; he has loaded swift-flying insects with weights; and he has thus, in the first place, ascertained this great fact, and that is, that muscular power is in inverse ratio to size—the smallest insects being capable of displaying the greatest effective force. Then he established the fact that a cockchafer is infinitely stronger than a horse, that it is even twenty-one times stronger, and that a bee is even thirty times more vigorous. The fact is that a horse cannot exert a stress beyond the sixty-seventh of his weight, while a cockchafer can easily draw a load equal to fourteen times its weight, and a bee, harnessed to a little wagon twenty times heavier than itself, can put the same in motion without any trouble. In other words, a cockchafer is capable of drawing with ease fourteen, and a bee twenty of its like. Can any one conceive of the wonders that man would accomplish were he so fortunately endowed, and had he at his services domestic animals possessing the muscular power of the insect? We stand in astonishment before the gigantic monuments of antiquity, but how much more gigantic would be the structures that man would erect had he at his service the power possessed by the most insignificant fly! Fig. 1 will give an accurate idea of the apparatus employed by M. Plateau to measure the amount of traction that insects are capable of exerting. Insects, being obliged to expend much power in order to sustain their flight, are not capable of lifting a very great weight, and they can scarcely carry prey that is heavier than themselves. Such is the case with the dragon-fly, represented in the engraving loaded with a ball of wax.

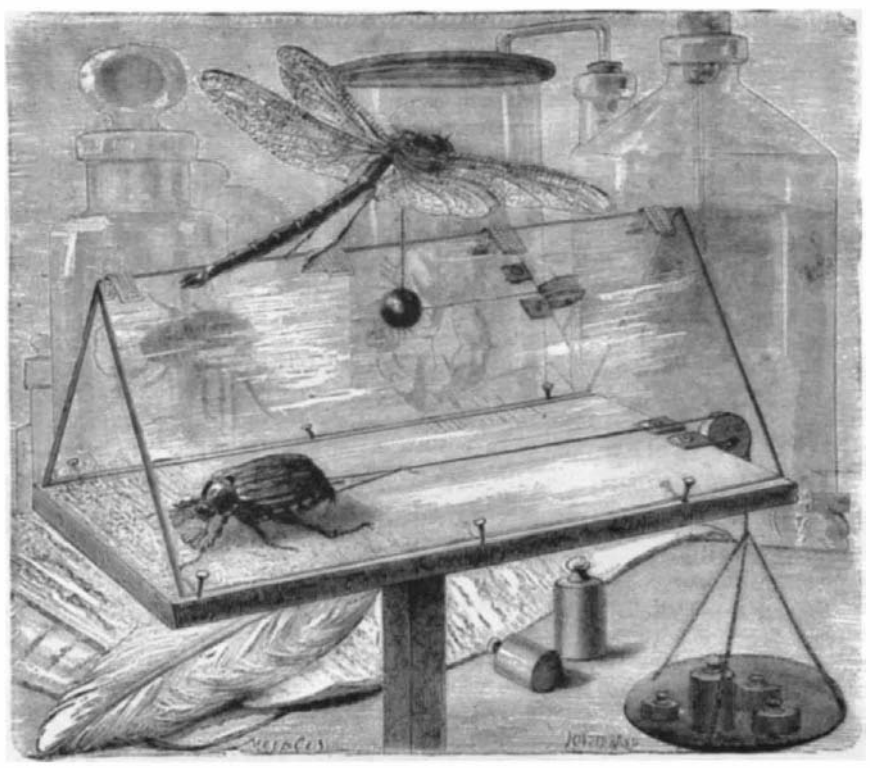


Fig. 1.—APPARATUS FOR MEASURING THE MUSCULAR POWER OF INSECTS.

Insects may be separated into two great divisions; (1) Those which have alar muscles inserted directly into the wings, and which have an independent system of muscles for each of these organs (the majority of *Neuroptera*, for example, in which each pair of wings may co-operate in flight without the intervention of the other pair), so that the removal of one of the pairs of wings does not carry with it the loss of power of flight. (2) Those which have only one system of muscles operating either one pair of wings or the two pairs. In the first case a single pair of wings is used in flight (*Coleoptera, Orthoptera*); in the second, the two pairs, connected with one another, are moved as one (*Lepidoptera, Hemiptera, Diptera*). It is essential to remark that wings do not perform the same rôle in all insects, and that they have neither the same dimensions nor the same structure in all groups. M. De Lucy has demonstrated that the surface of the wing decreases in proportion as the weight and dimensions of the animal increase; thus, for example, the gnat, which weighs four hundred and sixty times less than the stag-beetle, has fourteen times more surface than the latter, and the lady-bug, which weighs one hundred and fifty times less than the stag-beetle, has five times more surface. And we have daily before our eyes other examples of this same fact in butterflies (*Limenitis, Morpho*), with their delicate bodies and immense wings, and gad-flies, with their heavy, thick-set bodies and narrow wings. It may be readily conceived from this that there is no fixed relation between this surface and that of the animal to be lifted; but there is, as Pettigrew has observed, an invariable relation between the weight of the animal, the surface of the wings, and the number of oscillations that these make in a given time, "the problem of flight resolving itself into another one of weight, of power, of velocity, and of small surface, or, indeed, into a second one of feeble density, middling power, small velocity, and great surfaces—weight being an indispensable condition." Thus, the number of beats or oscillations of the wing being, in a common fly, 330 per second, and in a bee 190, they are, in a dragon-fly, no more than 28, and in the cabbage butterfly only 9 (M. Marey).

It is generally believed that, in all insects in general, the nerves form an aeriferous, tracheal network which is thought to play an important rôle. But this is not so. In *Lepidoptera, Neuroptera,* and *Hymenoptera,* all the nerves contain a trachea, but in *Coleoptera* and *Diptera* there is only one tracheal branch, this being in the costal nerve; the development of the tracheal network and of the nerves is correlated with the dimensions of the wings.

Many authors have tried to make out that the elytra cooperate in flight, and have asserted that these often act as parachutes during descent; but observation does not justify their opinion. The *Cetonia* (4), whose wings remain joined during flight, seemed an embarrassing exception, but M. Poujade, a young naturalist, has published some excellent figures representing a series of insects in the attitude of flight, and an examination of these shows us that many of the insects put their elytra in such a position that the latter cannot possibly obtain any purchase on the air. The *Necrophori* (8 and 9) and the *Silphæ* (2) straighten their wings, invert them, and arrange them on the abdomen in a horizontal plane; the *Onthophagi* (5 and 6) raise them simply, and cause them to turn about the suture as if on a hinge; and the *Histri* (7) place their elytra perpendicular and horizontal to the axis of the body, but, extended, they hardly exceed the auxiliary pieces of the lower wing. Nos. 2 to 9 are instructive in more senses than one, for they show us the very peculiar position of the median legs, raised above the body, while indicating to us the position of the anterior edge of the wing during flight, thus allowing us to understand that it really operates like a kite. Thus we see a new confirmation of the explanation that we have given of the mechanism of flight.

2. 3. 4. 5 and 6. 7. 8. 9.

Fig. 2.—THE FLIGHT OF INSECTS.

The alar surface is, by all means, infinitely too great, and it may be largely reduced without detriment. This fact has been most fully demonstrated by the experiments of MM. Girard, Pettigrew, and Jousset de Bellesme. At least a third part of the four wings of dragon-flies and a third part of the two wings of common flies may be removed perpendicularly to the anterior edge without modifying the flight of these insects; and the hind wings of some butterflies and *Hymenoptera* may even be removed completely without preventing aerial locomotion.

I will add to this subject an experiment of my own.

Having caused all the humble-bees met with on a trip to the Botanical School of the Garden of Plants to be captured and brought to my study, I anæsthetized each in turn, and sure of operating on them without lesion, I as delicately as possible cut off their lower wings. The window was wide open and the weather was fine; and as each amputated individual came to, he took his outward flight, apparently not the least bit affected by the loss of two of his members. The next day I captured my invalids on the flowers around the school, at some hundreds of feet from the place of operation.

In the *Diptera*, however, the loss of the small rudimentary organs called the "halters" or "poisers," which take the place of the inferior wings, destroys the power of flying upward. Physiologists and naturalists have ascertained this fact, but without being able to give a reason for it that is entirely satisfactory. Dr. Jousset de Bellesme, as a result of some interesting experiments in 1878, was led to believe that the function of these halters was to restrict the course of the wing backward, to thus carry the axis of sustentation forward of the center of gravity, and thereby provide for upward flight.

From all such experiments as permit of measuring the effective surface of the wing there is derived one fact of capital importance, and that is, that the membranous posterior portion of the wing may be clipped and trimmed and mutilated with impunity, but that the anterior stiff edge must not be removed nor even wounded, for the costal and subcostal nerves perform precisely the same rôle as the cross stick in a kite—and what child is there who does not know that the removal or even the breaking of that stick will prevent his plaything from rising in the air?—*J. Künckel, in La Nature.*

Another Giant Squid.

After a severe northwesterly storm at St. John, Newfoundland, accompanied by the highest tide observed there for many years, a giant squid came ashore near the steamer wharf, Portugal Cove, Nov. 12. It was captured by fishermen, and is the first fresh and unmutilated specimen ever secured. It measures thirty three feet from the tail to the extremities of the long tentacles.

The Corwin's Collections.

The collection of specimens and relics brought back from Arctic regions by the Arctic cruiser Corwin is described as large and interesting. Lieutenants Myrick and Doty have accumulated a rare assortment of models of weapons and boats used by the tribes inhabiting the extreme northern limits of the habitable portion of the globe. These models include boats of various shapes and character, hunting weapons, pipes, bird traps, nets, and other trinkets which would prove invaluable to a collector of the curios in any portion of the world. Dr. Ross, of Washington, who accompanied the expedition, has a collection of very rare specimens from the Alaskan and Siberian coasts, as well as from Herald Island and Wrangell Land. Among these are specimens of the flora, vegetation, soil, and minerals of the newly acquired territory, New Columbia. Among the flora may be seen some of the most delicate and beautiful flowers, and while all are void of brilliant colors, the leaves and blossoms, all of delicate tints, are very beautiful and extraordinarily curious as coming from an unexplored land so close to the North Pole. The grasses are also delicate, and resemble both the common bunch and "foxtail" variety of California and the blue grass of the Eastern States. The rock from Wrangell Land is a coarse blue sandstone, a fine slate, and some pale drab sandstone, all good building material. The specimens of coal from Cape Lisburne, on the north coast of Alaska, are of a deep black color, soft and bituminous. It is easily ignited, and emits a strong sulphuric odor. From Herald Island the Corwin brings some fine specimens of granite, which is susceptible of a high polish. It is gray in color, and resembles the granite of Lake Superior and the coast of Maine. Among the curiosities in the possession of Mr. Haloran, the boatswain of the Corwin, is the tooth of a mammoth found upon the shores of Siberia. It is as large as a 20-pound cannon ball, and being petrified, is equally as heavy. The collection of curios brought down from the Arctic by the Corwin is, perhaps, the most interesting of any brought to San Francisco.

THE ELECTRIC LIGHT IN BARCELONA.—We learn from Don Francisco Tarre, of Barcelona, Spain, that the electric light is now being successfully introduced in that city by the Spanish Electrical Society. The Gramme machines are used.

Another 8,000 Ton Steamer.

We recently gave an account of the coming over here of the new steamer City of Rome, and now we have to record the arrival of another great vessel of the same class, the Alaska, of the Guion line, between New York and Liverpool. On this her first passage, as a matter of precaution, steam was only carried at 65 lb., though she is fitted to carry 100 lb. Her best run was 402 miles in a day; but it is believed she will, before long, make 440 miles.

The Alaska is an admirably proportioned vessel. Her gross tonnage is 8,600; tubular length, 526 feet; breadth, 50 feet 6 inches; depth, 40 feet 7 inches to upper deck, 48 feet 7 inches to promenade deck. Her engines are of the compound, inverted, direct acting, cylinder type, the high pressure cylinder being 68 inches in diameter, and the two ton pressure cylinders 100 inches diameter each. The indicated horse power is 11,000, the highest on any steamer in the world. She is built with five decks, the first being the promenade, which runs the full length of the deck, excepting for short breaks aft and forward. For the accommodation of cabin passengers her fittings are most complete, the large saloon being the entire breadth of the vessel and situated amidships. Tables and revolving chairs are provided for 280 passengers, and the upholstery and other furnishings are handsome. Be sides the large air ports along the sides of the saloon, there is a stained glass dome overhead, thus furnishing ample light and ventilation at all times. The staterooms are ranged on either side of long passageways, forward and aft of the saloon, each connected with the steward's department by electric bells and furnished with electric lights. The smoking room, ladies' boudoir, social hall, and card rooms are elaborately fitted up. The second cabin is aft, and much attention has been paid to the comfort of second class passengers. The steerage is well and conveniently arranged. The officers' quarters are on the main deck. The vessel is steered by steam, and has steam windlasses and winches for weighing anchors and handling cargo.

She has four masts, the two forward ones being square rigged, and the others schooner rigged. She is built of iron in a series of water-tight compartments, and is provided with the most modern methods for insuring safety and comfort at sea.

Large Photograph.

A photograph, probably the largest ever printed upon a single sheet of paper, is now on exhibition in the art gallery of the American Institute. It is not uncommon to see several views which have been separately printed on small sheets of paper and pasted together to make a panorama of large industrial works, etc., but this remarkable specimen was printed from seven negatives on one sheet of paper, and covers an area of over ten feet in length by about eighteen inches in height. It is a panoramic view of the Centennial grounds in Philadelphia, Pa., and so perfectly are the negatives joined that it is impossible to locate the joints. Were it not for the announcement of the exhibitor that it was printed from seven negatives, no lay observer would imagine that it was other than a single view printed from a single negative.

Duplicates of this picture have been sold at very high prices as sample works of photo art. One was presented to Queen Victoria, and is said to occupy a conspicuous place in the royal gallery. This work is from the gallery of F. Gutekunst, No. 712 Arch Street, Philadelphia.

His exhibit includes other fine specimens. A notable one is a picture five feet long by eighteen inches high, also on a single sheet; and some large views in printer's ink which combine the effect of fine steel engraving with exactness of detail that can only be obtained by the use of the camera. This latter style is especially desirable for views of engineering structures and machinery, which enables the observer to study construction with confidence.

Antidote to the Poison of Serpents.

Very interesting experiments have been made in Brazil, by M. De Lacerda, which have established the fact that permanganate of potash is one of the most energetic antidotes to the venom of snakes. M. De Lacerda has addressed a memorial of his important works to the Academy of Sciences (meeting of the 12th of September, 1881).

The result of these researches is really astonishing: thus, in a series of experiments, frequently renewed, of injecting the active venom of *Ioshrops*, diluted with distilled water, in the cellular tissues or the veins of dogs, M. De Lacerda found that the permanganate of potash was able *to stop completely the manifestation of local injuries from the venom.* Yet the same poison, which had served for these experiments, being injected without antidote into other dogs, always produced great local tumefactions, with loss of substance and destruction of tissue.

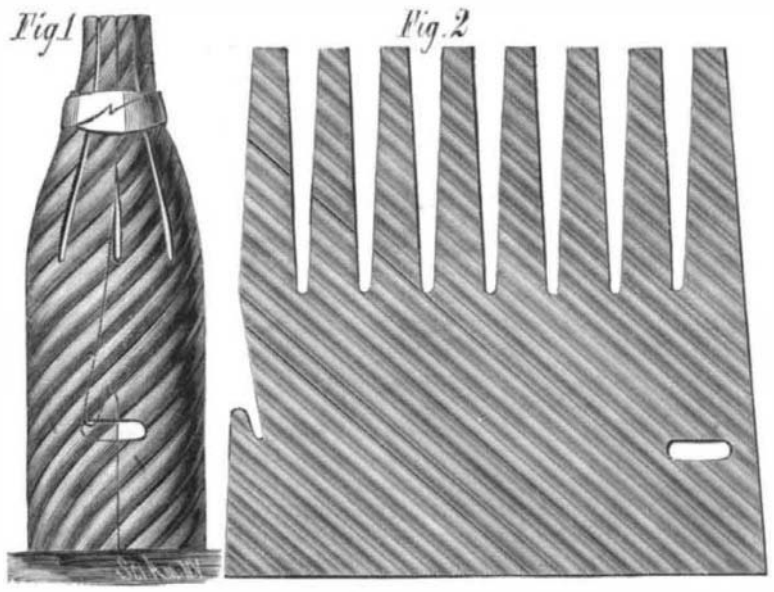
These very remarkable results have been stated on various occasions, not only by the Emperor of Brazil, who assisted at these experiments, but also by physicians, professors of faculties, and members of the diplomatic corps.

NOVEL BOTTLE WRAPPER.

The engraving shows an improved protective bottle wrapper lately patented by Messrs. H. J. Mark and W. F. Martinek, of St. Louis, Mo.

The body of the wrapper is made of veneer or pasteboard, having attached to it thick paper corrugated diagonally. At one edge of the wrapper there is a locking tongue, and near the opposite edge there is a slot for receiving the tongue.

The upper edge of the wrapper is slit to form a series of elastic fingers, which are drawn together about the neck by means of a paper band or tie. Fig. 1 shows the wrapper in its flat state; and Fig. 2 shows the manner of applying it to the bottle.



NEW BOTTLE WRAPPER.

IMPROVED SOLDERING IRON.

The engraving shows a convenient means of adjusting the coppers of soldering irons on their handles, and also for keeping the handles cool.

Fig. 1 is a side view, with handles in an open position. Fig. 2 is a side view of the copper. Fig. 3 is a side view, showing the handles closed and the copper attached. Fig. 4 is a cross section on line *x x* of Fig. 1, and Fig. 5 shows a modified form for wooden handles.

The two portions of the handles are pivoted together to form the jaws, each having a pin or lug on its inner face. The copper is of suitable form, having a cross aperture, into which the pins of the jaws enter when the handle is closed.

IMPROVED SOLDERING IRON.

The shanks of the handle are formed of malleable iron, and their outer ends are enlarged to form a hollow handle. This portion has numerous perforations, which allow circulation of air to keep the handle cool.

On the inner side of the handle are ratchets for engagement when the two parts are closed, to prevent them from slipping apart. With this construction the handles can be removed from the copper while it is being heated, and heating of the handle prevented. The copper may be turned at the desired angle before being clamped tightly by the jaws, and the angle may be readily changed while the tool is in use.

In using wooden handles in place of the hollow bulbs, the inventors provide a ring on the shank, as shown in Fig. 5, which, when slid outward, holds the jaws closed.

This invention was lately patented by James and Thomas H. Hughes, of Spencer, Mass.

MISCELLANEOUS INVENTIONS.

Manufacturers of paper-hangings will find it to their interest to examine the paper-hanging machine and rack recently patented by Mr. Henry Staib, of New York city. In the manufacture of paper-hangings the web of paper as it comes from the printing machine is carried to a rack, where it is suspended to dry in loops on sticks placed at intervals. This invention principally relates to mechanism for taking the paper and carrying it upon the racks, and to the racks used for supporting the paper, whereby the work is facilitated and the operation rendered automatic. In this mechanism rocking arms, which receive their motion from a rotating shaft, first move downward, and, striking a projection on a belt, which has its return movement controlled by a weight, cause said belt to carry the lower stick of a pile of sticks out upon the rocking arms, which are notched to receive the stick. These arms then move upward and deposit the stick, having the paper over it, on rack-bars above in front of pawls attached to slide-bars. A loop of paper is thus carried to and remains suspended from the rack, while the rocking arms move back to receive another stick and loop. The slide-bars then move forward and the pawls carry the stick and loop of paper, after which said bars move back to receive the next stick brought up by the rocking arms, and at the next forward movement both sticks are carried forward. This operation is continued to any desired extent. There is also combined with the slide-bars a roller for automatically marking the web to insure uniformity of the rolls into which the paper is finally made, and a counter for registering the number of loops of paper.

Mr. William T. Lyons, of Decherd, Tenn., has patented an improvement in ice machines which is deserving of notice. The invention consists in a refrigerating apparatus composed of an air-exhausting pump and an air-supply pump separately connected with a series of pipes in a refrigerating chamber for obtaining circulation of air through said pipes by the operation of the pumps, the exhausting one of which is of greater capacity than that which supplies air to the pipes, whereby the air is rarefied, and the atmospheric air drawn in by the smaller pump, in passing through the rarefied air, absorbs more or less heat and reduces the temperature in the refrigerating chamber to the extent required.

An improved life preserver, which appears both simple and practicable, has been patented by Mr. Rosendo Torras, of Brunswick, Ga. This device mainly consists of two parallel cylinders made of any suitable, flexible, waterproof material, supported internally by longitudinally arranged helical springs, and connected externally by gyves, the rings of which encircle the cylinders, and which gyves may be laced with tie ropes. This construction admits of the cylinders being compressed in direction of their length and retained in a small compass, and, when distended, of their forming a pontoon for buoying shipwrecked persons. The extensible cylinders are fitted with flexible receptacles for food and water arranged within the springs and accessible from the exterior by necks projecting through the gyves. There is also combined, with the device, an oar for steering or propelling the raft, and which is constructed so that it may be used to lock the cylinders both in their distended and closed conditions.

An automatic hog-feeder, the object of which is to facilitate the feeding of hogs and prevent waste of the food, has been patented by Mr. Hiram T. Phenix, of Oketo, Kan. This device is formed in part of a box of any desired length and depth, according to the number of hogs to be fed and the quantity of food to be given at a time, and of such a width that two hogs may feed from opposite sides without their heads coming in contact. Said box, which has openings in its opposite sides of a size sufficient for a hog to insert its head only, is divided by longitudinal and transverse partitions into food chambers and feeding compartments having inclined covers and regulating slides, whereby the food is only supplied as it is eaten and the escape of food from the food compartments can be shut off when desired. By means of this feeder the hogs cannot waste the food, and cannot get their feet into it and dirty it.

A very simple and useful fastening for pocket book handles, which provides for the handle being shut up within the pocket book when not required for use, has been patented by Mr. Thomas P. Spencer, of New York city. The invention consists in the combination with the pocket book frame having slots and bars across the slots, of hinged straps connected with the handle, whereby the said handle can be swung down into and inclosed within the said pocket book, the cross bars of the slots forming the hinge pivots of the straps to which the handle is attached.