CHATEL'S DIRECT ACTING STEAM COCK.

The bronze cock shown in the annexed figure consists of a shell, *a*, closed at the top by a hemispherical cap, K, with which is cast in a piece the two guides, *c c*, which serve to maintain in a vertical position the conical key, *b*. When the hand wheel, V, of the screw, F, is revolved, the nut, *d*, which is connected with the key, *b*, by means of the projections, *h*, moves upward or downward and carries along with it the key.

It will be seen from this that the arrangement of this cock allows of the integral section of the pipes being preserved—a first class advantage that is not met with in ordinary cocks; for the section of these, being usually different from that of the conduits, diminishes the pressure of the steam.

As the key of the cock under consideration does not revolve in the shell, it follows that there is no griping. As for the closing of the cock, that is perfect because of the great surface of contact of the key and its seat.

PERREAUX'S STEAM TRICYCLE.

We must go back more than two centuries to find the first idea of a steam carriage, and this is due to Isaac Newton. who proposed it in 1680. His system, which was one of the most rudimentary, was nothing else than an aelopile mounted on wheels. Specimens of it are still to be found as scientific playthings in a few cabinets of physics.

The first tricycle based upon the principle of the steam engine was built by Cugnot, in 1770. To begin with this date, projects have not been wanting, the solutions proposed benefiting each time by the progress of the steam engine applied as a fixed motor. Murdoch in 1784, Symmington in 1786, Read in 1790, Trevethick in 1802, etc., successively proposed apparatus which to-day are forgotten. In 1804, Evans invented the *oruktor amphibolis*, a sort of boat-carriage, the first and last amphibious steam vehicle that has ever been built. We may cite also the steam carriage of Griffiths in 1821, of Gordon in 1822, of Gurney in 1828, of Anderson and James in 1829, and of Hancock in 1833.

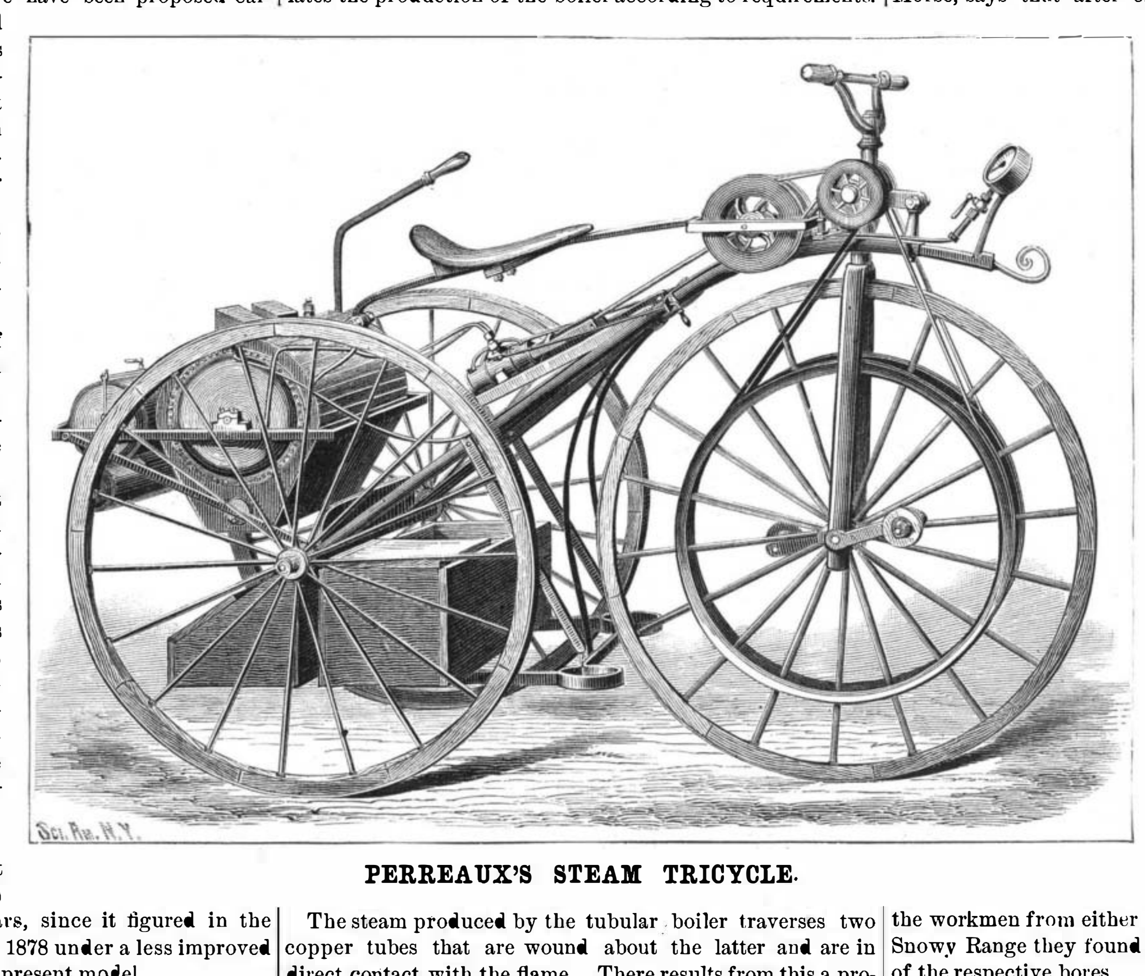
The latter was the most fortunate of all inventors of such vehicles, since, in 1835, he had not less than three of them in current service, making the trip by steam on the Paddington route. According to Mr. Thurston, Hancock succeeded in constructing a light steam phaeton for his own use, which ran in the city among horses and carriages, without interfering with or injuring any one, at an ordinary speed of ten miles per hour, and which could be increased to twenty.

The success of locomotives on rails somewhat diminished the ardor of experimenters in this direction, and, in fact, competitions became impossible for steam street carriages.

To-day the question has assumed a transformation. Owing to narrow gauge locomotives and to tramways in the streets, there are no longer any endeavors to build vehicles designed to supplant horses, but there are still endeavors being made to get up a self-propelling vehicle, convenient and easy to maneuver, designed to receive a small number of persons—one or two at the maximum—and capable of operating regularly for a few hours without demanding too great an amount of attention on the part of the one who drives it.

With this object in view, there have been proposed carbonic acid machines, compressed air motors, and electric motors supplied by piles or accumulators. The few experiments that have been tried in this direction have not as yet given very striking results, but the end is far from having been reached.

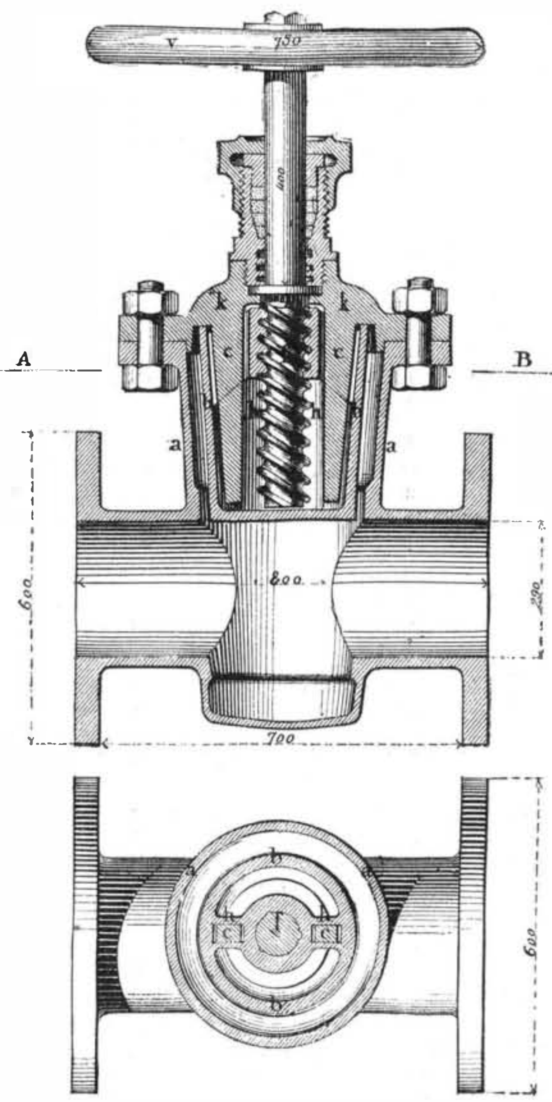
Other inventors are continuing their researches in regard to thermic motors, and more especially in regard to steam motors. As one of the most curious of these latter we may call attention to the steam tricycle of Mr. L. G. Perreaux, one of our compatriots, whose labors are the more worthy of being better known and encouraged from the fact that the inventor has followed up his idea with remarkable perseverance for fourteen years, and has made considerable sacrifices of time and money to perfect his apparatus. Now that his patents are about to become public property, just on the verge of a success that he had hoped for to indemnify him for his outlays, we deem it of interest to briefly describe Mr. Perreaux's system, which, by a singular coincidence, presents some analogy with that of Sir Thomas Parkins, than which it is older by several years, since it figured in the Universal Exhibition of Paris in 1878 under a less improved form than that possessed by the present model.



PERREAUX'S STEAM TRICYCLE.

Mr. Perreaux's first experiments were made with an ordinary two-wheeled velocipede carrying the boiler behind the seat of the driver, and the motive mechanism under the seat. It is evident that such a type can only serve for experiments and in a few rare cases. It requires a very peculiar ability on the part of him who maneuvers it, and, for this reason it was, in the experiments, fixed to a whim of four meters radius.

In its present form the apparatus is a tricycle whose fore wheel constitutes the motive and steering one, while the hind wheels support the boiler and the greater part of the weight of the driver. The pedals serve for starting the vehicle; for the motive system, which is of very small



CHATEL'S DIRECT ACTING STEAM COCK.

dimensions, would not always do this quickly enough. The boiler, which is tubular, is heated by the vapors of alcohol furnished by a reservoir filled with that fuel, which is itself heated by an alcohol lamp having several wicks. The vaporization of the alcohol which burns under the boiler is regulated by a system of registers, which increases or diminishes the number of lighted wicks, and consequently regulates the production of the boiler according to requirements.

The steam produced by the tubular boiler traverses two copper tubes that are wound about the latter and are in direct contact with the flame. There results from this a production of superheated steam which is afterwards sent to the motor. The use of superheated steam permits of a better utilization of it and requires for a given work a much less weight of it, thus diminishing the weight of feed water to be carried on the apparatus. This superheating of the steam presents no danger, since it is performed on but a very small quantity at a time, and since the pressure never exceeds four atmospheres, as may be ascertained by the pressure-gauge placed in front of the apparatus. The motive system is a small engine having a single cylinder of 22 millimeters in diameter, and a stroke of 40 to 50 millimeters. Mr. Perreaux estimates the work produced by his tricycle at 6 kilogrammeters per second, and that produced by his bicycle at 4 kilogrammeters. The escape of steam takes place under the seat, and the feed is effected by means of a small pump that draws water up into a small reservoir whose capacity is calculated for about a three hours' run without renewal. Motion is transmitted from the motor to the fire wheel by means of cords and pulleys. The driver has within reach all the parts, such as cocks, etc., necessary to operate the apparatus, and can, at will, allow himself to go at an ordinary speed of 12 to 15 kilometers per hour, or else aid the running by working the pedals with his feet so as to increase the speed. All the parts of this interesting little machine are constructed with remarkable ability; and in his last model the inventor has taken advantage of his experience in the introduction of numerous modifications and simplifications which we shall advert to after experiments have been tried with them. The question presents so much interest that we shall not fail to be present at such experiments nor to inform our readers of the results obtained.—*La Nature.*

The Action of Saliva in the Stomach.

Numerous samples of gastric juice pumped out of the stomachs of healthy persons, at different stages of the digestive process, have shown that during the early stages no hydrochloric acid can be detected even when the fluid is strongly acid. The period at which this acid first makes its appearance varies in different individuals, and, with a mixed diet, seems to depend primarily upon the quantity of food taken. After a light breakfast the hydrochloric acid will be found in three-quarters to one hour, but after a full dinner it does not appear for two hours.

Industrie Blatter says that Reinhard von den Velden has been experimenting upon the effect that saliva has on the gastric juice. These experiments showed that when starch paste was mixed with acid gastric juice (free from hydrochloric acid), and fresh saliva added, the mixture at once imparted a light yellow color to an aqueous solution of iodine in iodide of potassium. On the other hand, whenever the juice contained hydrochloric acid the iodine always gave a blue color, no matter how much saliva was added, or how long it was kept in an incubation stove. From this he concludes that there are two separate stages in digestion; that in the first the saliva can act, in the second the pepsine alone acts; the former is an amylaceous digestion, the latter an albuminoid. The latter will, of course, begin as soon as the juices are acid, but only takes place in full force when free hydrochloric acid is present.

Denver and South Park Railway.

In announcing the completion of the Gunnison extension of the Denver and South Park division of the Union Pacific the general passenger agent of that company, Mr. J. W. Morse, says that after crossing South Park it enters the Arkansas valley, and leaving it pushes up Chalk Creek canyon to within 600 feet of the summit of the great Saguache range of mountains, and there, far above timber line, at the altitude of eternal snow and ice, it enters a tunnel 1,800 feet in length, and piercing the most rugged of the Rockies. Emerging from the tunnel on the Pacific slope, 11,524 feet above sea level, the enchanting valleys of Quartz Creek and its numerous tributaries, and 150 miles of monster mountains, stretch before the eye—a view of stupendous peaks and rugged canyons unexcelled for grandeur on this or any other continent. Alpine Tunnel, the first to pierce the main range of the Rocky Mountains, is the highest railway tunnel in North America or Europe. The approaches of the Denver and South Park division of the Union Pacific on either side are marvels of engineering skill, laid through scenes unrivaled for grandeur and magnificence. Although the tunnel commences with a sharp curve at its eastern end, so nicely was the engineering done that when the workmen from either side met in the heart of the great Snowy Range they found only about one inch of variation of the respective bores.

THE official returns regarding the army show that the education of the German recruits has been yearly on the increase since 1875. In that year 2·37 per cent of the recruits could neither read nor write. In 1881 it was 1·54.

The Nutrition of the Heart and the Source of its Muscular Power.

In a lecture that H. Kronecker delivered in Berlin lately, he referred to the seeming paradox that the potash salts, which have long been considered as dangerous, and were known to be powerful cardiac stimulants, are present in the blood in considerable quantity, being conveyed by it through all the organs of the body without injury to them.

He explained this striking phenomenon by assuming that the potash salts were not dissolved in the blood, but were combined with or contained in the blood corpuscles. He proved this by a lecture experiment, in which a frog's heart continued to beat, undisturbed, when unchanged blood was injected into it, but quickly died when blood was sent through it that had been frozen and thawed, so that the corpuscles were bursted and the potash salts dissolved. In conjunction with McGuire he showed, as long ago as 1876, that blood containing these broken corpuscles owed its poisonous properties to the potash salts alone, for it can be freed of the injurious constituents by diffusion (dialysis), and, the other diffusible constituents being without action on the heart, the danger must lie in the potash.

Another curious point which McGuire, working under Kronecker's direction, had demonstrated was, that the corpuscles of the blood do not contribute to the active power of a frog's heart, for the pure serum of the blood has the same action as whole blood.

Blood corpuscles are necessary to sustain respiration, but are not required to nourish muscular tissues. They are, in fact, injurious to this extent, that they favor the production of carbonic acid, and thus place the tissue in a kind of asphyxiated state. The accumulation of carbonic acid quickly reduces the power of a muscle. It is, however, only necessary to pump the carbonic acid out of the blood in order to revivify the heart that it is passing through, without adding oxygen. Hence carbonic acid acts as a direct poison, while blood with carbonic oxide is almost equally as nourishing as the normal blood. Carbonic acid differs from potash salts essentially in this, that it does not kill the heart, but only enfeebles its action for the time being.

After a longer rest the heart produces a weaker pulse, and this is due to the asphyxiating action of the carbonic acid formed in the tissues of the heart itself. Gradually the pulse grows stronger with each beat, and is like ascending the steps of a stair. The phenomenon can be reversed by filling asphyxiated blood into a fresh heart.

Is this due to poison or to the withdrawal of nourishment?

It has been supposed that the development of the heart's energy was due to the consumption of a substance contained in the tissues of the heart itself. But experiments made with the frog-heart manometer, which allows us to compare the action of the most different substances upon the heart, by passing different liquids through it, have proved that the substance of the heart itself is not consumed. When all nutritive matter is washed out of the heart by means of a harmless solution of salt, the power of the heart gradually decreases. If the blood or serum contained in the cavities of the heart are displaced by salt water (0·6 per cent), the pulse sinks very rapidly until it is imperceptible, and soon nothing but peristaltic motions remain, and finally the heart stops, incapable of making the slightest motion in response to the strongest irritation. Then, if oxygenated blood is again thrown into the sleeping organ, a slight twitching begins, and then it beats feebly, until finally the action is as violent as in its fresh condition. If a heart that has been deprived of blood until apparently dead is filled with serum or diluted blood (1 part of blood to 2 of salt water seems to act best), the most beautiful gradations or "steps" can be observed.

The heart is a wonderful piece of mechanism, not merely because of the great force which it displays, or on account of the very perfect system of valves that it possesses, but also because it is able to go to work almost instantly as soon as it is fed, and because it utilizes to the fullest extent, in the most economical manner, the force at its disposal. As soon as the liquid that it is expected to pump is withdrawn it stops work entirely, and does not consume itself doing useless work, but keeps in good condition for a long time.

When the heart works, it always works with its full strength and with suitable velocity; it is not at all affected by changes in the amount of stimulation it receives, and this is essential to its power of moving comparatively heavy burdens with constant uniformity. Under conditions that hasten the decomposition of food (such as heat), the mobility of its parts increases; under external conditions which retard the change (as cold) it moves more slowly.

What is true of the muscles of the heart may safely be assumed to be true for other muscles. Hence we must conclude that Liebig's views were incorrect, although they have long been accepted. In his celebrated "Chemical Letters" he says:

"In animals the unorganized constituents of the blood are converted into organized tissues, and when these break up into disorganized or inorganic bodies, the force stored up in them becomes manifest in a great variety of ways; it resembles the galvanic battery . . . which consumes itself in producing new magnetic, electric, or chemical effects."

This view, Kronecker thinks, must be abandoned as incorrect, for the frog's heart was able to continue its maximum work for twenty days after it had been freed from all the constituents of the blood. Hence the work done by the muscles is not accomplished by the consumption of their substance or tissues.

The next question is: What substances are able to keep the heart's machinery in motion? Albuminoids, as well as many carbohydrates and fats, have been designated as generators of muscular power.

A series of very careful experiments made by Martins on frogs' hearts proved that none of the non-nitrogenous bodies in blood or muscles are able to nourish the heart, and that none of the albuminoids, except serum albumen, are adapted to this purpose. Neither glycogen nor sugar, white of egg, nor syntonine or peptons, neither myosine nor globulin are able to sustain its action. Von Ott found that milk owed its nutritive power to the serum albumen alone.

Kronecker has further shown that the facts learned from a study of frogs' muscles may be generalized, and very probably they can be applied directly to the whole animal, and also be transferred to the warm-blooded animals, so that serum albumen may be designated as sufficient to sustain the tissues in general.

But the salts dissolved in the serum are by no means unnecessary there. A solution of serum albumen in distilled water stops the heart, for *water acts as a powerful poison to the tissues*. It is only when salt is added in small quantities to water that the tissues can endure it. It has long been known, and numerous experiments prove, that common table salt, in definite quantities, acts in this way. Other salts, in solutions of definite strength, act in a similar manner as preservative agents of the tissues (antiseptics).

It is to be hoped that the experiments now being made regarding the action of certain tissues toward various dilute salt solutions will furnish scientific data on which to explain the therapeutical action of mineral waters.—*Naturforscher.*

Scientific Hanging.

Dr. G. M. Hammond, of this city, in a recent communication to the *Medical Record*, on the proper method of executing the sentence of death by hanging, cites a number of authorities and cases, all going to show that the practice of jerking the body by the neck with a view to dislocation, is wrong, useless, and barbarous. He says:

In hanging, death takes place either by asphyxia or apoplexy, or both. As Taylor remarks, if the cord is loose or applied too high up on the neck, a small quantity of air may still reach the lungs, and life will be prolonged till the slower death by apoplexy takes place. The main object of the executioner should be to adjust the noose in such a manner as to close the windpipe at once, so as to produce immediate asphyxia. Usually, both apoplexy and asphyxia result if the execution is properly accomplished.

According to Remer, of 83 cases of death by hanging, 9 were by apoplexy, 6 by asphyxia, and in 68 both conditions existed. Of 85 cases collected by Casper, in 9 there was apoplexy, in 14 asphyxia, and in 62 both conditions.

My own experience was somewhat similar to that obtained by other observers, except in the fact that strangulation was not carried to that point at which respiration ceases entirely. My object was more particularly to demonstrate the painlessness of the operation than to show the existence of any new sensations. With the assistance of two medical friends, I was partially strangled in the following manner: After being placed in a sitting position in a chair, a towel was passed around my neck and the ends twisted together. Of course with every twist of the towel very forcible compression was made on the entire circumference of the neck. One of my friends was intrusted with the operation of twisting the towel, while the other was stationed in front of me in order that he might watch my face, and at the same time make the necessary tests of the cessation of sensibility.

My sensations from the first twist of the towel may be briefly stated as follows: I first noticed a sensation of warmth and tingling, beginning in the feet and quickly passing over the entire body; vision partially disappeared, but there was no appearance of any colored lights. My head felt as if about to burst, and there was a confused roaring in the ears, such as is heard when the ear is placed against the opening of a shell. I suffered no loss of consciousness, and was fully able to tell my friend whether I felt any pain from the knife thrusts he was inflicting upon my hand. In one minute and twenty seconds from the commencement of the operation all sensibility was abolished. After a few minutes' rest, a second trial was made in the same manner as before. This was followed by symptoms similar in character to those mentioned in the first attempt, except that sensibility ceased in fifty-five seconds. A stab with a knife sufficiently deep to draw blood was indicative of no sensation whatever.

Taking into consideration my own symptoms, and the accounts of those cases previously described in this paper, it is obvious that the proper and orderly way to execute the law in the case of a person condemned to death by hanging, is not to let him fall or to jerk him into the air, but to stand him on the ground, or on a suitable platform, and to adjust the noose carefully around his neck below the larynx. If he is made to fall through a trap or is lifted suddenly from the ground, this important end can never be assured. The noose is almost certain to become displaced, and hence death is not so sudden as it ought to be. Having arranged the noose properly, the condemned person should be raised from the place on which he is standing by pulling on the rope, which should pass over a pulley fixed to a beam above, and he should be allowed to hang for thirty minutes. The rope should be soft and flexible, so as to fit closely to the neck. Probably one of cotton or flax would be preferable to the hempen cord usually employed. Carried out in this manner, an execution by hanging will be effectually and mercifully performed. The condemned would undergo no physical or mental suffering from the moment the suspension began, and his life would be taken as speedily and with as much freedom from horrible events as the circumstances of the case would allow. It would be better with persons weighing under one hundred and fifty pounds to attach a weight to the feet, so as to insure a sufficient degree of traction on the cord. It is supposed by many that the dislocation of the neck produces instant death; such, however, is by no means certainly the case. There are instances on record in which the vertebræ of the neck have been dislocated and recovery has taken place. Moreover, even when death does occur, it is no more instantaneous than when asphyxia is accomplished, and there is no greater freedom from convulsions. In some recent cases of hanging there were no convulsions of the limbs, and yet the neck was neither dislocated nor broken.

Of these things we may be positively sure, that from the instant suspension takes place there is no sensibility to pain, and that the convulsions which ensue are no more evidence of pain than are the movements of a decapitated chicken. They are such as always ensue with insensibility when the blood vessels of the neck and the trachea are suddenly closed.

Fruit Protection.

President William Saunders, in his recent address before the Entomological Society, of Ontario, said:

California has for some years past been shipping fruits from her abundant surplus to all parts of the continent, and her favored climate furnished conditions under which pears, apples, plums, and grapes prospered to an extent unknown elsewhere, and for many years almost free from the insect pests which in other fruit-growing regions levy so heavy a tax on the growers. But this exemption could not be expected to be permanent. The codling moth made its appearance there in 1874, and ever since then has been increasing to an alarming extent, the climate favoring its propagation with a rapidity unknown in less favored districts, so that there are three, and in some instances four broods in a season. They attack the pears and quinces, as well as the apples, and destroy and disfigure a large quantity of fruit.

California fruit growers are also suffering from the phylloxera, pear tree slug, red spider, tussock moth caterpillar, the currant borer, a native tent caterpillar, *Clisiocampa constricta*, and a number of species of bark lice or scale insects, which attack apple, pear, peach, plum, orange, lemon, fig, and olive trees, being found alike on the bark, foliage, and fruit, and which multiply with amazing rapidity.

Recognizing the vast importance of the fruit crop to the State, the most stringent measures are being enacted for the purpose of subduing these pests. An act was passed by the State Legislature in March, 1881, in the interests of horticulture and viticulture, providing for the appointment of a State Board of Commissioners, one from each of the large fruit growing districts, with almost unlimited powers to restrain, seize, or prohibit the importation of anything and everything likely to aid in distributing these insect pests—any suspected vines, vine cuttings, trees, empty fruit boxes or other material likely to spread insects or contagion, and any willful violation of the quarantine regulations of this Board is considered a misdemeanor and punishable with a fine of from $25 to $100.

These commissioners are also charged with the duty of preparing rules to be observed by fruit growers for the extermination of insects, and suitable powers are given them to enforce the carrying out of these rules. In reference to the codling moth, every apple grower is compelled to scrape the rough bark off his apple trees every spring, to collect and burn the scrapings, and apply, after scraping, an alkaline wash—the constituent parts of which are specified—to the tree.

All boxes in which apples, pears, or quinces, have been stored or shipped are required to be dipped in boiling water containing a pound of commercial potash to each twenty-five gallons, for at least two minutes. These measures look to the destruction of the pupa. But, further, bands of cloth or paper of a specified width must be fastened around each apple, pear, and quince tree, before the fifteenth day of May in each year, and examined every seventh day afterwards throughout the season, and all larvæ or pupæ destroyed.

Precautionary and remedial measures are being enforced in reference to many other destructive insects, and any laxity or omission on the part of fruit growers in carrying out the instructions of the commissioners is punishable by fine. The chief officer of the commission is required to visit, examine, and report upon the fruit growing interests in the various sections of the State, appoint resident inspectors for each county to enforce the regulations adopted by the commission, and to experiment on the best methods of subduing insects and diseases destructive to fruits, and disseminate the information so obtained. For the carrying out of these objects an appropriation is made by the State of ten thousand dollars a year.

Humming Insects.

An array of mailed forms, including the "shard-borne beetle, with his drowsy hum," demands attention. In no beetle, and, indeed, in no other insect, do we meet the perfection of vocalization seen in the grasshoppers and their relations. And with the beetle we approach more clearly to the region of "hums" and droning, and leave that of specialized sounds, such as we have been metaphorically hearing in the cicadas. To pass from the latter insects to the beetles, bees, flies, and their neighbors, appears to be a transition almost as wide as that between the articulate language or arithmetic of culture and the scanty vocabulary of the savage or the primitive mathematics of the tribe who can count ten as represented on their fingers and toes, but ask in amazement why there should be more things in the world. In the beetles the sound producing organ is comparable to a kind of "rasp" which moves upon an adjoining surface. The site of the organ in question varies in different beetles. In some the rasps are situated on the upper surface of one or two of the tail segments, and are rubbed against the hinder edges of the wing covers. Sometimes the rasp is placed quite at the tip of the tail; and in some well known beetles (such as the weevils) the rasps may be borne on the wing covers and may produce the stridulating sound by rubbing against the edges of the joints of the tail. Among the sounds produced by beetles, the weird noise of the death watch (*Anobium*) stands pre-eminent. The sound produced by these beetles resembles the ticking of a watch, and they may be made to respond by placing a watch close by their habitats. The female death watches are known to tick in response to the sounds of the male insects. The noise is produced apparently by the insect raising itself on its legs and by its striking its chest against the adjoining wood. Thus the simple explanation of an insect call explains away the superstition expressed in Gay's line:

"The solemn death watch click'd the hour she died."

Butterflies and moths are known occasionally to produce sounds, which proceed, in one or two cases at least, from a drum-like membrane analogous to that seen in cicada. Mr. Darwin indeed mentions that one species (*Ageronia feronia*) "makes a noise like that produced by a spring catch, which can be heard at the distance of several yards." Among the bees, wasps, and other so-called *Hymenopterous* insects the production of the humming noise forms a fact of interest in the history of the race. And one or two species possess a power of emitting sounds of more definite nature, which correspond to the "stridulation" of the grasshoppers and their kind. But it is a well known and at the same time interesting fact that bees are known to express emotional variations by aid of their humming sound. "A tired bee," says Sir John Lubbock, "hums on é, and therefore vibrates its wings only 330 times in a second." A bee humming on á will, on the other hand, increase its vibrations to 440 per second. "This difference," says Sir John, "is probably involuntary, but the change of tone is evidently under the command of the will, and thus offers another point of similarity to a true 'voice.' A bee in pursuit of honey hums continually and contentedly on á, but if it is excited or angry it produces a very different note. Thus then," concludes this author, "the sounds of insects do not merely serve to bring the sexes together; they are not merely 'love songs,' but also serve, like any true language, to express the feelings."—*Belgravia.*

A New Intensifier for Gelatine Plates.

I have been experimenting during the last three months with (what is to me, at least) a new intensifier, which, as its principal ingredient is platinum, induces the hope of greater permanency than the usual mercurial intensifier, but of that I cannot speak with certainty. The formula stands thus:

SOLUTION I.

Chloride of ammonium	5 grains.
Bichloride of mercury	10 "
Thirty-grain solution of bichloride of platinum	1 ounce.
Water	20 ounces.

SOLUTION II.

Liquor ammonia	½ ounce.
Water	20 ounces.

Two solutions are given, but it is rarely that more than the first solution is needed.

Immerse the negative to be intensified in No. I. solution and watch carefully the action. Directly the requisite density (a dark-brown color being the result) is reached remove and wash thoroughly. If, however, through extreme weakness or not stopping exactly at the right time, the image begins to bleach, let it continue until nearly white, and then wash and immerse in solution No. II.

For negatives requiring only a small amount of strengthening this process is splendid; and even when carried out so far as to render the use of two solutions necessary, there is no clogging of the shadows or intense yellow films, as is frequently the case with mercury alone. After washing thoroughly and immersing in solution No. II., the change takes place very slowly, the high lights gradually assuming a bluish-black, and the shadows clearing if the negative be an over-exposed one. This clearing of the shadows is very valuable, and, instead of having a thick negative taking hours to print, the result is a negative harmonious from high light to clear shadow. All the changes are slow and under perfect command.

If the negative be in the state best described as *nearly* dense enough, careful washing in the first solution will give just the requisite density, and then a thorough washing and immersion in—

Ammonia	1 drachm.
Water	20 ounces.

will yield a result as perfect as possible. After the ammonia solution has done its work the negative does not gather any more density, no matter how long it may be left in. One precaution is, however, necessary during both stages, and that is, the dish must be kept gently rocked, or streaks are likely to form.—*W. T. Wilkinson, in Br. Jour. of Photo.*

Potato Ivory.

This new "vegetable ivory" is made from ordinary potatoes—provided they are tolerably sound and fully developed—by purely chemical means. The selected tubers must first be carefully peeled and the "eyes" cut out, all "spongy" and discolored portions being also scrupulously pared away. The peeled tubers should then be allowed to soak for a short time, first in plain then in acidulated water, sulphuric acid being the agent employed, and the mixture should be quite cold before the potatoes are put into it.

The next, and most important part of the process, is that of boiling the vegetables in diluted sulphuric acid for a considerable time, herein lying the gist of the invention, the secret of which is kept rather closely at present, but a short series of well organized experiments would probably enable any of our friends to elucidate the question.

The variety and age of the vegetable itself, the time for which it is subjected to the action of the acid, and especially the strength of the latter, are all matters of great importance to the object in view as affecting the quality of the preparation. As some little guide, however, we may bear in mind the process for "parchmentizing" paper, which is effected in the cold, and also the fact that heat greatly enhances the action of all acids upon organic substances, so that as the potatoes according to our advices have to be "boiled" in the liquid, a comparatively more dilute acid should probably be used.

Treated in this way the entire substance of the potatoes hardens and becomes gradually less pervious. When "done" they are to be taken out and washed in a stream of first warm and afterward cold water, the subsequent drying process being in all instances a slow and gradual one. Potato ivory thus prepared is not very unlike the ordinary "vegetable" kind, but is said to be of a more even "grain," as well as easier to turn, while it is not so liable to split when exposed to the influence of a very dry atmosphere.

Potato ivory is of a creamy white tint, hard, durable, and elastic, it being even adapted, it is stated, for the manufacture of billiard balls. There is no difficulty in dyeing or coloring the material either during the process of preparation or afterward, and altogether it would seem that this new product is one which is capable of an immense number of useful applications. To its other good qualities it adds that of being exceedingly cheap. We should have said before that the sulphuric acid used must be quite free from impurity, even traces of nitric or hydrochloric acid being detrimental.—*Monthly Magazine.*

Can Plants Assimilate Carbonic Oxide?

A series of experiments made by Stutzer to settle the question as to whether plants can make the same use of carbon monoxide, CO, that they do of the dioxide, CO_2, gave a negative answer. L. Just, in a discussion regarding the conditions of the experiments, showed that they did not justify any definite conclusions. The latter, therefore, instituted a series of new experiments in which no India-rubber tubing was used for making the connections. The vegetating vessel consisted of a flask into which the mixture of air and gas entered through a potash apparatus to absorb all the carbonic acid, and as it made its exit it likewise passed through a potash apparatus in which the carbonic acid could be retained and measured. The liquids required to sustain and nourish the plant were admitted and withdrawn through a peculiar form of funnel that closed air tight, so that it was not necessary to open the vessel.

In the experiment it was desired to observe the increase or decrease of dry substance in the plants experimented upon. In each series of experiments comparative measurements were made with atmospheric air that contained the usual quantity of carbonic acid, and with air entirely free from it, also with atmospheric air free from carbonic acid, but mixed with carbonic oxide in quantities gradually increasing from $\frac{1}{25}$ per cent up to 80 per cent. These experiments led to the following results:

1. The carbonic oxide furnished to plants exposed to the light was not used by them.

2. Carbonic oxide injures many kinds of plants, but not until the quantity present exceeds 10 per cent of the atmosphere in which they are. The injury is shown by a disturbance of the chlorophyl formation, diminished assimilation, less growth, and the new formation of organs is smaller. If there is 20 per cent of carbonic oxide in the atmosphere, the injury becomes perceptible at the end of three weeks, but is sooner noticeable the higher the percentage of carbonic oxide. After the removal of the carbonic oxide, the plants are able to overcome, in part, the injury they have suffered, provided the action of the gas did not last too long and that there was not too much of it present.

3. The chlorophyl granules do not possess any special power of absorbing carbonic oxide gas.—*Investigations in the Domain of Agric. Physics.*

Gossamer Spiders.—Autumn Flights.

A boating party on the Charles River, above Waltham, Mass., encountered, the other day, a cloud of gossamer spiders. One of the party, "W. A. F.," tells a Boston paper that the air seemed to be full of them. The strands were so delicate and so nearly transparent that they could scarcely be seen except against a background, or in looking toward the sunlight, when they appeared like microscopic threads of spun glass. Presently a small spider was seen skimming over the smooth surface of the water at a rapid rate, leaving a triangular wake behind. As the little navigator was not moving his legs, there was evidently some outside force to propel or draw him along. At first this could not be discovered; but, watching closely, it was seen that a thread of gossamer, perhaps ten feet long, was floating in the air, before the almost imperceptible breeze, and that the little fellow, fast to the other end, was drawn along over the surface by his tiny sail. Great numbers of these were noticed. Then others were discovered sailing through the air, with long, glassy streamers stretching out before them. Some seemed to be inclosed in a filmy envelope of the gossamer web, but others were merely attached to a single strand. Occasionally the little aeronauts would be seen ascending or descending their microscopic cordage, the upper ends of which merely floated in the air, while the other ends were attached to the bodies of the little spinners.

Occasionally the floating films would be broken, and leave the spiders on the water. Then they seemed to be able to travel on the surface until they were wet, when they would become, apparently, helpless. Thousands upon thousands of these strange travelers were seen floating in the air or skimming along the surface of the water, on the voyage from Waltham to Newton Lower Falls, and the reeds and rushes along the banks bore a silver fringe of these unsubstantial films, which glistened in the sunlight like threads of silver. Before the return trip was made a brisk breeze had started up and completely cleared the river of the liliputian navigators and aeronauts.

A correspondent, writing from Prattsburg, N. Y., October 15, reports a flight of gossamer spiders on that afternoon, which lasted for over an hour. The wind was blowing from the northwest.

Food Makes the Man.

Speaking roughly, say the *Lancet*, about three-fourths, by weight, of the body of man is constituted by the fluid he consumes, and the remaining fourth by the solid material he appropriates. It is therefore no figure of speech to say that food makes the man. We might even put the case in a stronger light and affirm that man *is* his food. It is strictly and literally true, that "A man who drinks beer thinks beer." We make this concession to the teetotalers, and will add that good sound beer is by no means a bad thought factor, whatever may be the intellectual value of the commodity commonly sold and consumed under that name! It cannot obviously be a matter of indifference what a man eats and drinks. He is, in fact, choosing his animal and moral character when he selects his food. It is impossible for him to change his inherited nature, simply because modifications of development occupy more than an individual life, but he can help to make the particular stock to which he belongs more or less beery or fleshy or watery, and so on, by the way he feeds. We know the effect the feeding of animals has on their temper and very natures; how the dog fed on raw meat and chained up so that he cannot work off the superfluous nitrogenized material by exercise becomes a savage beast, while the same creature fed on bread and milk would be tame as a lamb. The same law of results is applicable to man, and every living organism is propagated "in its kind" with a physical and mental likeness. This is the underlying principle of development. Happily the truth is beginning, though slowly and imperfectly, to find a recognition it has long been denied.

A Monster Steel Spring.

On the 17th of October, there was made at Pittsburg the largest steel spring in the world. It is the first of a series of eight, destined to act as street car motors. The initial spring was made of open hearth steel, with a carbon percentage of 0·55. The ingot was cast 14x14 inches and 7 feet long. This was rolled down to a bloom 6x4 inches and 24 feet long. To properly heat this bloom, a heating furnace 30 feet in length was built at the Superior Iron and Steel Works, Pittsburg. The next operation, the final rolling, was the most interesting, and was only possible through the use of the Kloman "universal" mill or rolls. These had been devised by the late Andrew Kloman, and have become widely known in connection with the first successful rolling of weldless steel eyebars for structural purpose. By means of hydraulic pressure, acting through a toggle joint, an enormous pressure can be brought to bear upon the metal during its passage between the rolls, while a very quick reversal is also possible. The steel bloom referred to was rolled in this mill, in 30-foot sections, down to a length of 150 feet and 6x½ inches, and finally to a length of 310 feet and a perfectly uniform width of 6 inches and thickness of ¼ inch. Its weight was then 1,700 pounds; and to ship it, the spring was coiled in ten layers around a 4-foot pulley, the latter being given a slow motion as the band emerged from the heating furnace. The process of tempering and final coiling, etc., will be done in Philadelphia by the United States Spring Car Motor Company.