

States. The United States has no voters. No one can vote for Federal officers without being competent to vote for State officers. It follows from this decision that women cannot become voters until they are authorized by the States in which they live.

Correspondence.

The Grasshopper.

To the Editor of the Scientific American:

I have received the most valuable of all books, the *Science Record*, for 1875. I notice an article on page 456, on the habits of the grasshopper, by Professor Humiston. I differ from his description of their method of depositing their eggs. He says: "The tail of the female locust consists of a hard, bony, cone-shaped substance, capable of being thrust into ground from $\frac{1}{2}$ to 1 inch in depth. Just above this, on the body of the insect and attached to it, is the egg cell; the grasshopper is able to push its conical tail down into the ground and leave it there, with the cell containing the eggs."

I wish to state that the grasshopper does not push her tail into the ground, nor does she leave it there. The cone part, as he describes it, is a hard, forked, bony terminus, both above and below the anus. It is capable of being moved, and the female uses it as a drill. She does not leave the tail (as he calls it) with the eggs; but deposits the eggs, with draws the tail, and goes about her business. His view as the hatching in spring time are correct.

Leroy, Kan.

J. G. SHOEMAKER.

An Improvement Wanted in Street Railways.

To the Editor of the Scientific American:

One of the greatest needs of street railroads is some simple and economical invention to keep the rails, where they meet, in a level condition; or in other words, to prevent the end of the forward rail from sinking below the end of the rear rail. The device at present used is an iron plate placed under the junction of the two rails; but this does not entirely prevent the evil.

I invite the attention of inventive minds to this subject.

SAM. L. PHILLIPS, President.

Office of the Third Avenue Railroad Company, New York city.

Is Candy Injurious to the Teeth?

[From a paper by Dr. John T. Copman, read before the New York Odontological Society.]

Most certainly it is. For outward proof of it I will refer you to any candy-making village in our country, as the village of Neponset, Mass., where the shocking condition of the teeth, of the youth brought up in proximity to large candy manufactories, shows plainly the cause. But this is perhaps negative proof, and we should seek for proof positive, because other causes than those of the use of candy may be the reason, in this instance, of the disease.

But by far the most injurious consequence in the use of candy is in its indirect action through the system, first by its constituents, second by its disturbing action.

By long research I have discovered that the effect of the use of cane sugar, in small or in large quantity, is to produce a more or less constipated state of the alimentary canal, more particularly the refined sugar of the present day.

If, then, the balance of intestinal action is normally correct, the presence of sugar always disturbs it.

There is a point that may be stated here, and that is the action of sugar on an exposed nerve. We eat bread, meat, vegetables, and our "exposed nerve" makes no complaint; but the moment a little sugar is dissolved in the tooth, the tissue sets up a cry. What does it mean? Does it mean that it dislikes it—that it is discordant to the system? Does it mean that it is injurious to the fleshy or to the bony substances, or both? I have as yet not solved the problem. Who will do it? By an analogy we must conclude that cane sugar is injurious, and yet there may be other reasons and other causes for the pain produced in the tooth.

Besides the sugar contained in the candies of the present day and the coloring matters (mostly made of tincture of cochineal, which is harmless) are occasionally other material, such as pigments of green and yellow, which are poisonous.

We have a large number of essential oils, or medicaments, every one of which has a peculiar medical effect on the system, toning it up or down, binding up its parities or loosening them, and to these medical effects much of the injury of the confectionery of the present time is due.

A small catalogue of these essential oils and flavors may be interesting:

Group No. 1.—Peppermint, checkerberry, sassafras, lemon, clove, anise, cassia or cinnamon, vanilla, rose, caraway, coriander, cayenne.

Group No. 2.—Jargonelle pear, strawberry, pineapple, banana, peach, almond.

Group No. 3.—Boneset, licorice, horehound, ginger, cardamom, chocolate, butter, cocoanut, cordial, brandy, gum arabic, acids.

In purchasing a pound of mixed candies, you may perchance get all of these flavors in one lot.

Now I do not pretend to say that one is likely to be poisoned by such a compound, but I do say that, when a mother gives a three year old child an ounce of peppermint drops to eat, she should know the effect of them when eaten—that she ought to know she is giving the child a medicament as well as an ounce of sugar; she ought to think and be taught that the effect of the oil of peppermint is definite, and that an ounce of peppermint drops will, if they are strong—and of course

they are supposed to be good only as they are strong—contract the walls of the stomach and the small intestines, producing in a young child sometimes a spasm and inflammation, shown by a thirst for water, and a general disturbance of healthy action.

Such is, I believe, the general action of the essential oils of confectionery in group No. 1. The oil of cassia or cinnamon is very irritating. The oil of cloves is considered by many as destructive or poisonous. As a rule, the essential oils retard digestive action in the same manner that they preserve from decay meats and fruits, by retarding fermentation, or making compounds with digestible or decaying substances.

The pear and similar flavors in group No. 2 are imitations; they are chemical flavors, and are decidedly unhealthy. The composition of them I have found to be as follows:

The jargonelle pear flavor is made of the acetate of amylic ether, which is prepared by distilling a mixture of fusel oil, acetate of potash, and concentrated sulphuric acid.

The pineapple is made from butyric ether dissolved in another portion of alcohol. Butyric acid is made from decaying cheese, grape sugar and chalk, fermented together.

Various mixtures of the ethers, with addition of various agents, such as acetic acid, camphor, orris, vanilla, the volatile oils, etc., result in imitations of strawberry, raspberry, apricot, currant, etc.

The tonka bean is used very much in place of the vanilla pod, to imitate the vanilla flavor.

The common oil of almond (bitter) always contains a considerable amount of prussic acid; this oil is said to be substituted sometimes by the oil of mirbane or nitro-benzole, eight or nine drops of which is said to have produced death.

The peach and almond flavors are also imitations, made from prussic acid in some form, and are very poisonous.

The third group contains medicinal flavors: licorice, boneset, or horehound, ginger, cardamom, all of which have a different action from the first group, being relaxants and diuretics, and will have that effect in greater or less degree.

There are varieties of which we will not here speak; but we must condemn the spirituous drops sold at the street corners, as decidedly impolitic and demoralizing to the little ones who may be tempted to buy them.

But the injurious effects of candies do not stop here. The pure essential oils are costly and are increasing in price yearly; substitutes must be found, adulterations are practised, and among the most common is the adulteration of the oil of peppermint with spirits of turpentine, a thing to be utterly condemned, especially as its action is, with exceptional persons or in exceptional cases, that of a violent and dangerous poison, and in all cases it is an irritating oil, producing congestion of the veins and coagulation of the blood (a useful styptic in cases of excessive bleeding, by the way); and yet I am informed it is used by the confectioner himself, and only with a rule to put in as much as he can disguise or cover up.

The use of laudanum in licorice cough drops should be condemned. Many a child has been injured by them without the knowledge of what was going wrong.

The lemon drops are supposed to be made of citric acid, and flavored with oil of lemon; but why citric acid, when oil of vitriol is so much cheaper? I have reason to believe that tartaric acid is most generally used.

But why cry down candy, the pleasant pacifier, that which fills the sweet tooth of the rising generation? Almost every one likes candy—a little now and then—almonds, sugar-plums, gum drops (now made to a great extent of glue). I do not cry it down, but must raise my voice against its excessive use, and ask whence comes the tendency, the appetite, for so much sweet? It seems to me to be occasioned by the great and increasing use of sugar in the family at home.

That which in the past was a luxury is now supposed to be a necessity. We have toned up our appetites until our viands are tasteless unless they are sweet with cane sugar. We daily spoil the flavor that God has placed in our food, by adding our own product to it.

If we wish to eradicate from our youth the very strong tendency toward high seasoning or high sweetening, we must begin at home, and tone down instead of toning up, and teach ourselves and our children to love the inherent flavors of the grains, the fruits, and vegetables; and as we and our children cultivate a love for them, so will their tastes grow, until this excessive sweetness will bear disgust, and their appetites will turn away from what cloy and sickens, and disturbs the normal condition of the human body.

I should refer to an article used to adulterate sugar, called *terra alba*—a white earthy substance—quite harmless, being sulphate of gypsum (anhydrous calcic sulphate)—profitable to increase the weight without being suspected by the buyer. It is said to be used in large quantities. It can be easily found by dissolving the candy in water; if any sediment remains, it is likely to be *terra alba*, or perhaps chalk, which is also used.

Hollow Structures.

Nature teaches us one of the grandest lessons in her economization of structures and materials. The stems of water plants are hollow and of various sections, as cylindrical, angular, or furrowed. Many of them, as all know from the revealings of the microscope, are of cellular or tubular construction. Examining the stem of a young dicotyledon cut across, we find the inner portion full of radiating cells of fibro-vascular bundles, of wedge-shaped section, the pith occupying the center. If we minutely examine these vascular bundles we shall find a layer of cells traversing the bundles; on the inside of this, toward the center of stem, the cells form the proper wood of the fibro-vascular bundle, and on the outer side, toward the circumference, the cells are closer and

more compact. The layer between these portions is called the *cambium* layer, and the stem of the oak and other *exogens* is strengthened by continual increase of woody fiber outside this layer, or the *liber* of the stem. We might go on illustrating, from a variety of plants, the remarkable adaptation of stems to their habitats and conditions of growing; some triangular in section, as in various water grasses, sedges, etc., exposing only an angle to the flow of the stream; others square and round in section, of beautiful symmetry, and which man has imitated in the art of construction, and in casting his metal into cylinders and shafts.

Not only in stems of plants and grasses, but in the bones of animals, we find the same hollow structure developed. In the case of birds, where lightness is most necessary, the substance of the hollow bones is remarkably thin. Take a feather. What a wonderful union of strength and lightness is there in it! We find this hollowness particularly evident in that end of the feather at which the muscles act, or at the short end of the lever.

Leaves show a similar adaptation of matter. Some leaves exhibit deep furrows or ribs which support the membrane or tissue, and give it a stiffness to withstand the pressure of the wind. Others have their surfaces indented or voluted, or formed of two or more convex lobes, thus giving rigidity to them. Again, shells and other organic forms possess cellular and corrugated parts in which the material is distributed to the best advantage. We have not been slow lately to avail ourselves of these lessons. Our tubular and cellular bridges, our iron vessels, our columns, and shafts of machinery, our iron roofs and walls, are instances of the employment of hollow and corrugated forms, and the extent to which they are applicable and may yet be employed is almost co-equal with the whole field of inventive genius.

But our primary object here is to call attention to some of the mechanical principles involved in these structures, and to indicate how the same principles may be applied to the uses of art. We have shown on what elements the strength of cast iron beams depends, namely, in putting all the metal into the shape of flanges on the extreme side of the neutral plane of the beam. Thus the inverted T shape answers this best in cast iron, as we have seen. Now, keeping this form in view, let us first examine the strength of a hollow cylinder. Here we find the material thrown at a distance from the central or neutral axis, and thus fulfilling the great principle of making the moments of resistance of the fibers the greatest possible. Thus let us take a solid cylinder of a given diameter. If we cut away or hollow it we shall find, although we are taking away a quantity of the material, we do not proportionately diminish its transverse strength; but if we place the material that we take out round its external surface, we greatly increase the strength.

The experiments of Mr. Hodgkinson upon columns of cast iron were conclusive in proving that the hollow cylinder was the strongest form of section under compressive force. These were conducted upon hollow tapering columns, upon cross sections, as used in the connecting rods of steam engines, and upon forms in which the metal was cast in the shape of the letter H. All these forms proved considerably weaker than the hollow cylinder of equal weight of metal. As the relative merits of these forms of casting metal are of constant use we append their proportionate strengths: Hollow cylindrical pillar, 100; H shaped pillar, 75; + shaped pillar, 44. The examples were all of the same weight and length, with rounded ends.

General Morin's rule for the thickness of cast iron pillars may be relied upon, as it is based upon the founder's experience of the minimum thickness.

Height, feet, 7 to 10, 10 to 13, 13 to 20, 20 to 27; minimum thickness, inch, 0.5 0.6 0.8 1.0

Another rule is to make the thickness in no case less than 1-12 of the diameter. Cellular or tubular girders exemplify to a still greater degree the value of hollow construction. The Conway bridge, in North Wales, designed by Mr. Robert Stephenson, is an instance of the application. The two tubes of this bridge are each 25 feet high in center, and 14 feet wide externally, 420 feet long, and weigh 1,300 tons. The material is chiefly disposed in the top and bottom parts or flanges, and these are also composed of small tubes or cells to give additional stiffness. The sides are of plate iron riveted together, and each tube is really an immense beam, of slight diminution toward the ends. An iron ship is really a tubular or cellular beam, approaching a rectangle in section, and undergoing various strains. The waves are the points of support, sometimes near, and often wide apart: while occasionally the whole vessel is lifted and supported by one wave, like a pivot. Under these continually varying conditions, the deck and bottom of the vessel are subject to alternate compressive and tensile strains, and in very long vessels, like the *Great Eastern*, in a heavy sea, these strains are very formidable; and hence the value of adequate stringers under the decks, and diagonal braces, to stiffen the ship lengthwise and laterally, and bulkheads to prevent transverse or the rocking motion which a vessel often has when laboring in a heavy sea. Every deck and vertical division in a ship enables the ship builder to make his structure cellular, and gives him admirable opportunities of tying and bracing together the sides.—*English Mechanic*.

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