THE HEXAGONAL CELL OF THE HONEY-BEE.

BY W. J. WEEKS.

It has always been a subject of wonder, amounting even to a subtle mystery, how the bee could construct its congeries of waxen cells of such exact uniformity of size and shape, and combining with the least expenditure of room and material, the greatest capacity and the utmost strength. So difficult of solution has the problem seemed, and so unsatisfactory have the theories respecting it appeared, that some *savans* long since began to regard this geometrical feat of the bee as referable only to the divine presence and emanation. It is curious to remark the expressions of various writers in allusion to it, and selections from a few of them will be here presented as introductory to the forthcoming solution.

Dr. Evans has writen the following elegant lines:—

"On books deep poring, ye pale sons of toil,
Who waste in studious trance the midnight oil,
Say can you emulate with all your rules,
Drawn or from Grecian or from Gothic schools,
This artless frame? Instinct her simple guide,
A heaven taught insect baffles all your pride.
Not all your marshal'd orbs, that ride so high,
Proclaim more loud a present Deity,
Than the nice symmetry of these small cells,
Whereon each angle genuine science dwells."

Dr. Bevan says:—"A honey-comb is allowed to be one of the most striking achievements of insect industry and an admirable specimen of insect architecture. It has attracted the admiration of the contemplative philosopher in all ages, and awakened speculation not only in the naturalist, but also in the mathematician, so regular, so perfect is the structure of the cells, that it satisfies every condition of a refined problem in geometry. Still a review of their proceedings will lead to the conclusion (as Huber has observed) that the geometrical relations which apparently embellish the productions of bees are rather the result of their mode of proceeding, than the principle by which their labor is guided. We must, therefore, conclude that the bees, although they act geometrically, understand neither the rules nor the principle of the arts which they practice so skillfully, and that the geometry is not in the bee, but in the great Geometrician who made the bee, and made all things in number, weight and measure. The hexagonal form of the cells in a honey-comb has been regarded, and is indeed now generally acknowledged by philosphers, to be the result of the mechanical laws which influence the pressure of cylinders composed of soft materials. The nests of solitary bees and the *royal* cells in a bee-hive are uniformly circular; and the cells in the pith of wood, which are hexagonal in the central parts, are circular towards the circumference, where there is diminished pressure; hence it is inferred that the hexagonal form is produced by the general reaction of the solid parts on each other."

In the work on entomology of Kirby and Spence, the following remarks occur:—"The most profound philosopher, equally with the most incurious of mortals, is struck with astonishment on inspecting the interior of a *bee-hive*. He beholds a city in miniature. He sees this city divided into regular streets composed of houses constructed on the most exact geometrical principles and the most symetrical plan, some serving for store-houses for food, others for the habitations of the citizens, and a few much more extensive than the rest, destined for the palaces of the sovereign. He perceives that the substance of which the whole city is built is one which man with all his skill is unable to fabricate; and the edifices in which it is employed are such as the most expert artist would find himself incompetent to erect. And the whole is the work of a society of insects! Nor have its mysteries yet been fathomed. Philosophers have in all ages devoted their lives to the subject, from ancient Aristomachus of Soli, in Cilicia (who, we are told by Pliny, for fifty-eight years attended solely to bees), and Philiscus the Thracian (who spent his whole time in forests, investigating their manners), to Swammerdam, Reaumur, Hunter and Huber, of modern times. Still the construction of the comb of a bee-hive is a miracle which overwhelms our faculties."

Other writers, even to the latest, might be quoted without affording any more light in explanation of the mystery, yet the solution is so little abstruse as to be the occasion of much wonder that it should have remained so long undiscovered by the astute philosophers, mathematicians, and naturalists who have, for centuries, successively given it their attention.

[To be continued.]

DEFECTS OF CALF-SKIN LEATHER.

The article which we published on page 67 of the present volume of the SCIENTIFIC AMERICAN, on "dry rot" in calf-skin leather, has attracted considerable attention from all those interested in the leather business. The defect in calf-skin leather which we mentioned is admitted, but there is a difference of opinion as to its cause. One of our correspondents stated (on page 137) that he believed it was effected by the use of resin oil in dressing; while another considered it was owing to a want of moisture and air. A correspondent of the Boston *True Flag* (who states that he is an old currier) quotes our article, and gives it as his opinion that the cause of this leather rot is *potash*. We quote what he says on this head:—

"Now, then, I will tell you the *cause* of this 'rot,' leaving the SCIENTIFIC AMERICAN to furnish the *remedy*. In the first place, French skins are not, comparatively speaking, used in this country. They have been superseded by imitation. The great beauty or peculiarity of a French skin is its glove-like softness. About sixteen years ago, it was discovered that the oil in which deerskins are tanned—called 'sod oil,' and containing large quantities of potash—would, when mixed with tallow, produce the softness so much desired. The same effect may be produced by a mixture of potash, neatsfoot oil and tallow. Potash is not used in dressing cow-hides or kip-skips. Hence they are not subject to this rapid deterioration. When I was a boy a pair of boots would last me a year. Now from three to four pairs are necessary. Cause, *potash*. I am an old currier, and know the truth of the above statement."

The "old currier" no doubt knows what is used in dressing leather, but why does he make such a *dead-set* against a little potash mixed with neatsfoot oil, by attributing to it the whole blame of the leather rot, when he asserts that the deerskins of the Indians are treated with oil containing potash, and it is well known that these skins are not affected with dry rot? Here is an apparent contradiction to his conclusions. We, however, believe that potash is decidedly objectionable to use for dressing leather, because it forms a soap when mixed with neatsfoot oil and grease. Potash, like every other alkali, acts chemically upon leather and such like animal substances, and tends to disorganize them. If potash is the cause of dry rot in calf-skin leather, the remedy is easily furnished—*don't use it*. The correspondent of the *True Flag* is not exactly correct, however, regarding the use of French calf-skins in our country. We annually import foreign leather to the value of about $3,000,000 (not including gloves), and about $88,000 of boots and shoes.

A correspondent engaged in the manufacture of leather, writing to us from St. Louis, Mo., gives it as his opinion that the defects of calf-skin leather "are due to the excessive use of muriate of ammonia (sal-ammoniac) in the *bate*." This chemical substance when in excess will act injuriously upon the skins, because the alkali predominates in it. This remedy for this, he states, is better management of the skins in the *bate*. No more sal-ammoniac should be employed than will just suffice to neutralize the lime.

MAGNITUDE OF SOUTHERN RAILROADS.

In speaking of the southern railroads and of the prosperity of the southern States, the *United States Economist* says:—If their roads are few and ill-conducted, there is either a lack of capital or of commerce, or of both, or there is an unwholesome adherence to old ideas; if, on the contrary, their roads are numerous and well managed, the inference is clearly legitimate that a large amount of commerce is pressing for accommodation, and that it is under the control of a competent and intelligent people. Measured by this standard, the South has something of which to be proud. We have compiled the following statistics, showing the extent and the value of railroad property in the several southern States. The figures date up to the close of 1859, and show the length of road constructed or in the course of construction, the length in actual operation, and the cost of the roads, including building and equipment:—

States.	Length.	In operation.	Cost.
Virginia	2,058.5	1,525.7	$43,069,360
North Carolina	1,020.0	770.2	13,998,495
South Carolina	1,136.0	807.3	19,083,343
Georgia	1,617.2	1,241.0	25,687,220
Florida	730.5	289.8	6,368,699
Alabama	1,822.4	798.6	20,975,639
Mississippi	445.1	365.4	9,024,444
Louisiana	1,160.0	419.0	16,073,270
Texas	2,667.0	284.6	7,578,943
Arkansas	701.3	38.5	1,130,110
Missouri	1,337.3	723.2	31,771,116
Tennessee	1,434.4	1,062.3	27,348,141
Kentucky	698.4	468.5	18,852,062
	16,824.1	8,794.1	$265,960,842

POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

[Reported expressly for the Scientific American.]

On Thursday evening, the 26th ult., the usual weekly meeting of the Polytechnic Association was held at its room in the Cooper Institute, this city; Mr. Bruce in the chair.

MISCELLANEOUS BUSINESS.

Device for Teaching Children.—Mr. B. Brown, of Huntington, L. I., exhibited an apparatus under the name of the "Primary Instructor," designed for teaching young children to read, spell, cipher, &c. It consists of of a frame abont five feet square, with wires stretching across it, some horizontal, and some vertical. Upon these wires are strung cubical blocks, sliding and revolving independently of each other. At the left side of the frame are four vertical wires, each containing 40 blocks, on three sides of which are pictures of familiar objects, 240 in all. At the right of the object blocks are 10 vertical wires each carrying 40 blocks, in all 400. On each of these last are words, in all 1,200, being the names of objects, and appropriate adjectives and verbs. By this arrangement it will be seen that a picture of an object and its name in a considerable variety of simple sentences may be presented to the child. A small part only of the whole process is here described, but yet sufficient to convey an idea of its construction and use.

Mr. Godwin was well pleased with the apparatu, and thought that it should be recommended by a vote of the club.

Mr. Garvey—The apparatus is to be commended for its ingenuity, but is too complicated for practical use. The common numerical frame, with a few real objects, and a blackboard would be better. The theory is correct but is carried too far.

Mr. Seely had little faith in short cuts to knowledge, and even in such plausible schemes as phonography. The way we were taught to read, the loving mother or the school-mistress pointing out the letters with a penknife was perhaps the best. The letter A may be as interesting an object to a child as an elephant, and the acquaintance with it is more important. Knowledge of strange things is not what children need. The end of education should be to prepare the mind to receive knowledge. The fashion of the present day of cramming all sorts of sciences into a child's little head is altogether wrong.

Castors for Chairs and Sofas.—Mr. Garbanati exhibited (for Dr. Thos. P. Fry) an improved castor. The roller frame is provided with a spring, so that when the chair or sofa is occupied, the spring yields, and the chair rests firmly on its feet instead of on the roller, thus relieving the castor from the weight. The castors cost no more than the common sort, while it is claimed they will operate better and last longer.

The chairman then called up the regular subject —"Iron Buildings."

DISCUSSION.

Mr. Ayres read a paper repeating some of his statements at the preceding meeting, and adding other facts and arguments, in order to present a precise and comprehensive view of the whole subject. The paper gives a history of the use of iron in buildings, claiming for Mr. Bogardus the invention of the first and only successful plan of using cast iron as a substitute for stone and brick. Mr. Bogardus' first iron building was erected in 1848, and was taken down in 1858 on account of the widening of Duane-street.

Mr. Johnson—When was the first fire-proof building erected in this city?

Mr. Ayres—I cannot tell.

A Gentleman—Are there any fire-proof buildings in New York?

Mr. Ayres—Harper's building, perhaps, is nearest being truly fire-proof. The Crystal Palace, although of glass and iron, was easily destroyed, for the reason that the iron was supported by wood, and when the wood was consumed, the iron fell by its weight. The iron in a building should be an independent structure fully capable of sustaining itself and whatever rests upon it. On the question of expansion I may state that Harpers' Building is about 100 feet long and joins at each end with brick buildings. Yet here no effect of expansion has been observed.

Mr. Garbanati—Buildings may be fire-proof, yet their