this insect swarmed in such numbers as to cover every exposed surface, and literally to darken the air to a height of fifty to seventy-five feet. When the Ephemerae emerge from the water, their flight is weak and uncertain. Instinct teaches them that they are carrying an extra armor, and they seek at once the nearest support as a place on which to moult. At such times these insects are as easily disturbed as a swarm of bees. A gust of wind from an unexpected quarter, giving a slight rustle to the leaves, will often cause them to rise in clouds from each branch. This motion seems a circling one; but the appearance is probably due to the fact that many of the insects are moving back upon the branches, while others are still ascending. No other insects were at all common along the lake during this time. It may be worth placing on record that that venerable citizen known as the oldest inhabitant was speechless in the presence of these swarming millions. His memory could not recall another year in which the numbers were worthy to be compared with those of 1884. It will be impossible to convey in words an adequate conception of this invasion to those who have never witnessed any thing of the kind.

Near the dock at Lakeside there is an electric lamp suspended about twenty feet above the ground. As might be expected, this became an object for attack as soon as the current was turned on in the evening. On the morning of July 7 the layer of dead insects covered an area of not less than twenty-five square feet, and was fully *six inches deep immediately underneath the lamp*. Kelley's Island, four miles distant, appeared all the while as if enveloped in such a cloud of dust as rises over a race-course. On the evening of July 6 a wind compelled the insects to fly very close to the surface of the water, and their numbers appeared fully as great as the snowflakes of a winter's storm. During these ten days the invasion extended along the entire southern shore of the lake, from Buffalo, through Cleveland, Sandusky City, and Toledo, to Detroit. After a rain-storm the water of the lake was dense with them to a depth of at least two feet. Along the beach they were gathered in windrows. As far as my observation goes, fish will not eat the dead insects, but greedily devour living ones. The minnows are very expert at this work, rarely failing to make a capture if the insect has touched the water.

According to Packard, all the Ephmeridae pair while on the upper surface of the water. This is not strictly correct, for any afternoon one could see thousands of couples flying in the air and at elevations as great as fifty feet. When this took place over the water, the couple almost invariably fell into the lake, and was devoured by the fishes. Is nature producing a stronger-winged variety?

EDWARD T. NELSON.

Ohio Wesleyan university,
Delaware, O., July 28.

[The phenomena seen by Professor Nelson, as described by him, appear to be different from those witnessed by Rev. Mr. Abbott, and in all probability a wholly different insect was concerned. The myriads of Ephemeridae mentioned by both writers have been not unfrequently witnessed. A woodcut of a street-lamp in Cleveland, swarming with Ephemeridae, will be found in Morse's 'First book of zoölogy.' We have ourselves seen, from a long distance, windrows of their dead bodies and exuviae along the shore of Lake Winnipeg for very many miles, while the water of the lake was so covered with them that one could not dip up a cup of clear water. — ED.]

Man and the mastodon.

Having had occasion recently to look over numbers of the *American journal of science* of forty years ago, I have met with several notices of archeological interest. Among them is the following, in an article on the suburban geology of Richmond, Wayne county, Ind., by Dr. John T. Plummer, vol. xliv., 1843, p. 302: —

"A tusk [of the mastodon or mammoth] was exhumed from the gravel, fifteen feet below the surface, while excavating the Whitewater Canal, near Brookeville, about thirty miles south of Richmond; [and] a *club-shaped* implement, formed apparently of cliff-limestone, was also taken out of the gravel ten feet below the surface, near the spot where the tusk was found."

This implement is described as "seventeen inches long, rounded at one end, tapering towards the other extremity." I do not remember to have seen any reference to this in recent works; but as Dr. Plummer seems to have been an intelligent observer, and as he calls attention to the resemblance of this implement to an 'Indian hommony pestle,' and to the remarkable fact that it was found under the above conditions, the note should be borne in mind, and other implements looked for in the gravels of the vicinity named.

In the same article are noticed an ornament called ivory by Dr. Plummer, but probably shell, as like mistakes are often made (p. 301), mounds (p. 313), and (on p. 303) "several sticks, and a chip having palpable marks of an edged tool upon it," found nearly thirty feet below the surface in excavating a well in Richmond.

F. W. PUTNAM.

THE MADISON EDUCATIONAL CONVENTION.

THE meeting of the National educational association at Madison, Wis., which closed its sessions on Friday, July 18, was the largest ever held in this country, and probably the largest of its kind in the world. Every state and territory in the Union was represented, and over six thousand teachers were on the ground. The weather was fine, the town beautiful, and very bountiful in its hospitality, the excursions numerous, the speakers eloquent, the exposition, on the whole, more instructive, and in some departments larger, than at Philadelphia in 1876. Everybody was there, was heard, and most who desired it had some office provided for them, and had their names and words spread over the land by the efficient agent of the associated press. Half a dozen meetings were going on at the same time, and manuscript enough to run as many educational journals for the year was evolved; so that those who went will not need to read for one year. There were committee meetings

to fill every hour of the day; and more than once an honest teacher was said to have waked in the morning to find, that, in the small hours of the night before, he had been made president of some new society of which he had never heard. The agents of the railways, with fascinating chromos of attractive scenery, were organizing excursions at fabulously cheap rates for the neighboring lakes, and even for Alaska, whither a large party started the last day. Dignified and super-subtle agents of the many publishing-houses buttonholed every man who could and would help them, with an assiduity in every way worthy the greatest educational show on earth. Superintendents who needed new departures for their constituencies were seeking the support of the convention for all sorts of schemes and reforms. Societies for humanity to animals, temperance clubs, renowned champions of rights for women, Catholicism, represented by a no less adroit and subtle propagandist than M. Capel, were all on hand, and striving by every means in their power to make their cause heard in what all have come to feel to be the centre and source of all influences that are to be permanent and pervading in the land; viz., the public schools. Private, high, normal, industrial, collegiate institutions had meetings of their own more or less numerous. Dr. Graham Bell and the deaf-mutes, Gen. Armstrong and the Indians, Mr. F. Adler and his workshops, the Concord summer school of philosophy, the Quincy reform, were all represented by distinct addresses. An international league was organized, with nearly a score of officers, on the suggestion of an unknown enthusiast at Bonn, Germany; and at the end a very long series of resolutions, expressing the sentiments of a few end men on most of the open questions in the broad sphere of modern life, were approved; and then with fireworks and cannon, and bands of music and illuminations, and out and in door eloquence, the vast assembly dissolved.

This association is not a ring, though its offices and policy are entirely in the hands of a very few men; for its honors are empty, its offices gratuitous, and some of the best educators keep carefully aloof from it. That others are not recognized shows a want of wisdom at the centre, which reveals the weakness and instability of the entire organization. It was never more apparent than at this meeting, that education is, in this country, not a science, nor a profession, in any extended or respectable sense. Contrast the dismal time-killing trivialities which frittered away the time of the larger meetings, the emptiness of some of the addresses, the egotism and ignorance of others, with the method of a meeting of a scientific association.

Worst of all were, perhaps, the dismal hours of the so-called philosophy of education: any thing more stultifying and anti-pedagogic than most of this cannot be imagined. If a teacher can teach, he can interest a convention, or else is sure to have the sense to keep silent. By this test very few *teachers* were heard at Madison. No more earnest and inspiriting address was heard than Col. Parker's, whose iconoclasm the managers greatly fear. He is in earnest in his work; and no man was heard with greater interest, though perhaps rarely without some feeling of strong dissent. It is said, teachers are not in the mood for earnest work at such assemblies. This is often true of the eastern, but not of the western teachers; their enthusiasm is most inspiring, and may shame, as it is rapidly distancing, even the best of the more routine methods of the East. In view of this eagerness, some of the papers admitted by the president were a shame to him, and an insult to the intelligence and zeal of the hearers. There should be, before another meeting, a board of examiners to decide on the merits of papers, less with reference to names, and more to matter.

On the whole, the address of President Bicknell was wise and suggestive and all-sided. His organization of this year shows great administrative capacity, and a clear sense of the needs of the hour. What was wanted this year was mass, quantity, if only to show to outsiders the strength of educational interests. But progress is now so rapid here, that the wants of another year will be very different.

We hope the standard of the new president from the West will be quality first, and quantity afterward. Although in one sense he can hardly equal the success of this year, a higher kind of success desired by those who voted for him is possible. If he has the strength and wisdom to make it against all the solicitations which will tempt him, the most important new departure since the association was founded may be quietly made next year, even by a very small convention, in which quality shall be made the touchstone of all.

A BURROWING SPIDER.

In the somewhat heavy soil of certain fields, where but a scanty herbage thrives, the cave-making spider (Tarantula arenicola, as identified by the Rev. Dr. H. C. McCook) has excavated so many of the nearly perpendicular and cylindrical burrows, that the place is almost honeycombed, and the surface is conspicuously dotted by the irregularly five-sided towers erected above each opening. The burrows vary from one-quarter to three-quarters of an inch in diameter, and in depth from eight to twelve, or even twenty, inches; the smaller being formed, it is said, by the young, which enlarge them with their growth. The walls are compact and smooth, but without lining. Towers in other localities have been observed two inches high: none I have seen are above one inch, the majority being still less.

Among my captives, the most active workers are an adult and a half-grown individual, between whose actions, while digging, slight differences are observable. In a glass jar they refused to do more than attempt to escape by unavailing efforts to scale the sides, but, when set free in the garden, they at once began to exhibit their manner of burrowing, and disposing of the excavated earth. Most of the labor is performed by the large and strong mandibles, with the probable assistance of the fore-legs. A pellet of earth, frequently a third of the worker's cephalothorax in bulk, is loosened as the spider labors head downward, and is seized by the mandibles. The young spider turns at the bottom of the burrow, and ascends, head first, to the edge of the aperture, where the pellet is held just above the surface; then, by a blow from both fore-legs, it is thrown to a distance varying from four to twelve inches, usually falling in particles, so that no fresh earth is noticeable near the burrow-entrance. The half-grown individual then backs down the tube, and resumes work below. The mature spider, while the pit is shallow, ascends backward with the load, comes entirely out of the orifice, turns around, and, having popped the abdomen into the opening, throws away the pellet. She rests for a few moments, again turns within the cave, and descends, head foremost. Before returning to work below, however, she often carefully examines the edges of the burrow-entrance, and, if the earth has become dry and friable, strengthens it by threads of web, applied by longitudinal strokes of the spinnerets; and, if her movements have broken down the margins, she places her head under the edge, pushing and lifting the earth in a way suggestive of a dog's method of heaping dirt on a bone with his nose. She then applies more web, and resumes her digging. But, as the burrow deepens, the mature spider also turns while below. I have, however, never observed a young individual bring up a pellet backward.

That the spinnerets of this species take any part in pellet-making is improbable. Mrs. Mary Treat, while studying Tarantula turricula, observed their application to the earth-mass before its ejection. It is likely that Tarantula arenicola relies solely on the cohesion of the moist particles, without the addition of strengthening web, as I have repeatedly witnessed the dry soil of the field crumble to sand before the spider could get the pellet quite out of the tube.

The young specimen brought up a load at intervals varying from two to five minutes; and a cavern half an inch across and about one inch deep was excavated in an hour and a half. While deepening a burrow, a young spider in the field worked somewhat faster. Assuming a pit to be of the uniform width of three-quarters of an inch and twelve inches deep, the Tarantula must carry out the comparatively enormous amount of 5.31 cubic inches of earth.

The towers are usually composed of short pieces of grass (fig. 1) placed above and across each other in an irregularly five-sided wall. Occasionally small twigs are used. Indeed, almost any light object will be utilized if within reach, for the spider will not leave the burrow to search for materials. If nothing is attainable without such an effort, she will erect a low wall of earth. In several instances towers have been destroyed, and the ground cleared for a space of three inches radius; and from another place the sod was removed: but, in