A NEW ELECTRO MAGNET.

The ordinary electro magnet has the inconvenience of ceasing to exert an influence upon the armature at a short distance (generally a quarter of an inch) from its poles.

Mr. Stanley Currie has recently devised a new form, whose field of attraction is much greater, since it acts at a distance of 3½ inches. This new magnet is a combination of the horseshoe electro magnet and the solenoid. As shown in the engraving, it consists of a vertical bobbin with a tubular soft iron core. The wire which is wound upon the bobbin is surrounded by an envelope of soft iron of the same weight as the core, with a soft iron tube at the end of the bobbin that connects the core with the external envelope. The top of the bobbin is covered with a brass disk. The copper wire used is No. 18, Birmingham gauge, and 0·048 inch in diameter.

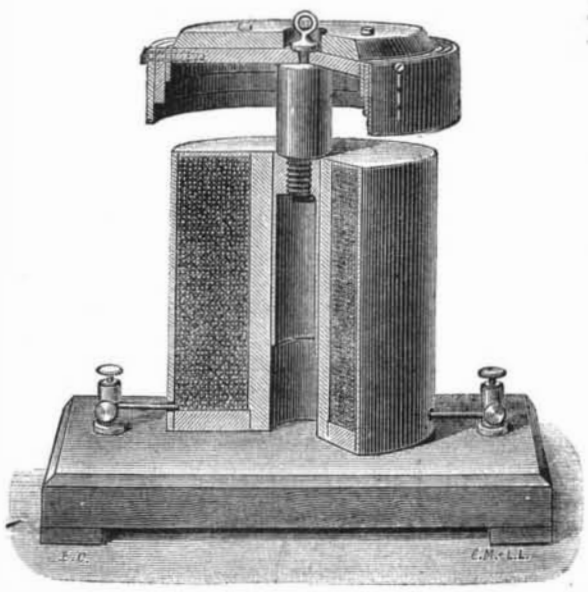


Fig. 1.—CURRIE'S ELECTRO MAGNET.

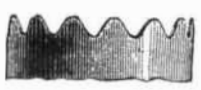


FIG. 2

The armature consists of three parts, viz., of an iron rod inclosed in a brass tube, which is prolonged beneath it so as to guide it in its upward and downward motion in the tubular core, and of a soft iron cover fixed to the top of the central rod, and connected with the cylinder which forms the external envelope of the bobbin. This cover is preferably made with two or more layers of flat plate, so as to facilitate demagnetization, but it must be thick enough not to be saturated by an ordinary current. The cylinder has a rim that enters the field of attraction of the external envelope as soon as the lower extremity of the central rod enters the tubular core. When the effect of such attraction has made itself felt, the upper flat plate is in the field of attraction not only of the envelope, but also of the internal core, and the field of attraction of the magnet is, so to speak, prolonged.

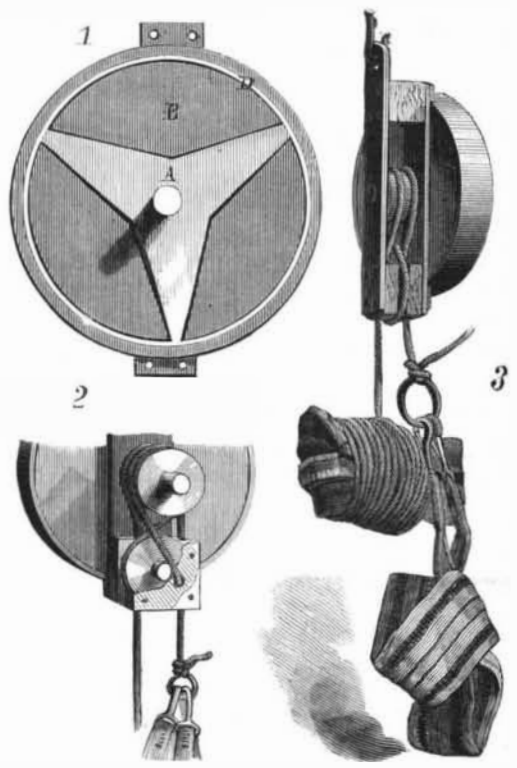
As long as the central rod is exterior to the core of the bobbin, the attraction to which it is submitted is always in ratio inverse the square of its distance from the bobbin; but, as soon as the extremity of the iron rod enters the aperture in the core, the part that rests therein loses its power of attraction. The same diminution of attractive power occurs in the rim of the armature's disk as soon as its lower edge passes under the upper edge of the bobbin. The power of attraction likewise varies directly as the mass of the body attracted, and these two effects have been combined in order to regulate the attraction so that it shall be approximately uniform across the field of 3½ inches. This is effected by cutting the lower end of the rod of the armature, as well as the rim. If necessary, the thickness of the upper disk and the width and thickness of the rim may be varied. The latter may also have its edge scalloped (Fig. 2), so as to prevent a sudden increase of attraction in measure as the disk approaches the bobbin. The result of this arrangement is to increase the stress upon the disk in measure as the latter approaches the pole of the magnet, when the force of the stress upon the armature rod and rim is diminishing. In this way, and by the combination of a counterpoise, there may be obtained a sufficiently uniform stress with considerable travel, and a violent contact be avoided when the disk reaches the pole of the magnet.

The stress or range of the attraction may be doubled with a pair of these magnets placed at a certain distance apart, and having the same armature rod. The lower armature is fixed to the rod, and the other simply bears against it through a projection. The upper armature is first attracted, and, when it has placed itself upon its own bobbin, the lower one has come into the field of attraction of *its* bobbin, and may be attracted to it, so that, by this process, the travel is doubled.—*La Lumiere Electrique.*

AUTOMATIC FIRE ESCAPE.

A simple automatic fire escape, recently patented by Mr. Frank A. Bone, of Lebanon, O., is shown in the accompanying engraving. It consists of an axis fastened to the center of a governor—shown in cross section in Fig. 1—and passed through the center of a frame. Passing through the bottom of the frame and over a roller on the axis is a rope of cotton or other suitable material, on each end of which is a belt provided with a snap catch. When not in use, one end of the rope is drawn up to the frame, and the other is coiled as shown in Fig. 3. The escape can be kept in any convenient place, and since it weighs but about 12 pounds, it can be carried easily to the place it is to be used, where a strong hook is provided to attach it to. In large buildings these hooks should be placed on all sides, so that escape could be made in any direction.

The escape having been attached to the hook, it is only necessary for the person who wishes to descend to snap the belt (the one which is at the top) about his body, and then swing out of the window, when he will descend at an easy and regular speed to the ground. The opposite end of the rope will then be at the top ready for use by a second person. The governor for regulating the descent is formed with a star shaped center, A, the rapid revolution of which forces the pieces, B, outward, causing them to press against the fixed band, D, which acts as a brake.



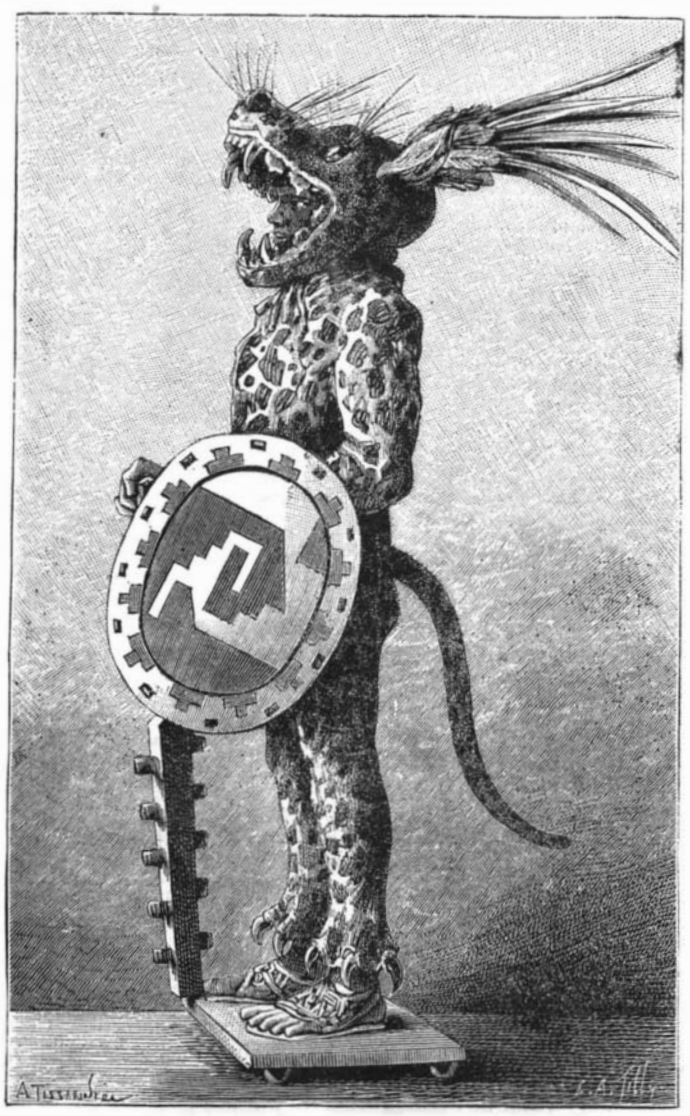
BONE'S AUTOMATIC FIRE ESCAPE.

AN AZTEC WARRIOR.

Mr. Eugene Boban, an antiquarian and traveler, well known to anthropologists and ethnographers, recently invited us to visit his establishment on Boulevard Saint Martin, in order to see the curious restoration he has made of the costume of a young Aztec warrior, a chevalier of the army of Montezuma (*Moctheuzoma*). The personage figures as a very skillfully executed manikin, which we represent in the accompanying cut. This truly remarkable object is designed for one of the largest ethnographic collections of Mexico.

The Mexican warrior of the epoch of the conquest (1521) was, as may be seen, clad in a material spotted to resemble the skin of a tiger, and wore a helmet shaped like the head of that animal. This extraordinary costume is assuredly one of the most remarkable that can be mentioned among military uniforms. The numerous voyages that Mr. Boban has made to Mexico, the innumerable documents that he has collected upon the antiquities of that interesting country, and the ability that the persevering antiquarian has acquired through study and research are so many guarantees of the accuracy of the restoration.

The warrior's mask was moulded upon the head of a living native of the valley of Mexico. The head of the tiger (*Ocelotl* in Aztec) is made of wood, just as it was by the ancient Mexicans. It is armed with long teeth, and is intentionally enlarged so as to form, through the open jaws, a true helmet. This latter not only served to protect the head of the combatant, but also to strike terror among the enemy. This idea of frightening the enemy was one of the principal studies of the military organizers of antiquity, and it has prevailed up to our own epoch, for otherwise we could not explain the presence of tufts of hair and large plumes upon modern helmets. The object of these is assuredly to increase the height of the soldier's head, and make him more imposing in the eyes of those whom he is attacking.



AN AZTEC WARRIOR OF MONTEZUMA'S ARMY.

In Græco-Roman times we find that there were soldiers in the armies who were muffled up in lion and tiger skins for the purpose of giving themselves a formidable aspect. This usage still obtains to a high degree at present in the extreme East, among the Chinese and Japanese.

The young Mexican warrior whom we picture wears the *tentetl* in his lower lip. This was a cylindrical piece of rock crystal (*teuilotl*), known in Spanish as *sombrerito*, "little hat." In fact, the object somewhat resembles our high hats. The *tentetl* was introduced into a perforation previously made in the lip. This custom of perforating the lips and inserting ornaments of varying size into them exists over the entire American continent, from Cape Horn to Behring Strait, and also in the equatorial parts of Africa.

The rock crystal *tentetl* was the badge of the officers of the Emperor's house, and was generally given as a reward to those who had taken prisoners.

Mr. Boban, like the old Mexicans, has used a spotted fabric for manufacturing the warrior's costume, the only difference being that the material is of linen, while that of the Mexicans was of cotton. The warrior is resting his right hand upon his sword—a sort of club armed with thin pieces of obsidian. This was moulded on a specimen brought by Mr. Boban from Mexico with his great collection, that is now on exhibition at the Ethnographic Museum of the Trocadero.

In his left hand the warrior carries a circular shield covered with buckskin. In the center of this is figured a hieroglyphic characteristic of the order of the Chevaliers of the Tiger. Around the wrists and ankles of the warrior are fixed enormous tiger's claws, and his feet are shod with *cactli*, a kind of sandals that are still in use among the aborigines. His head is surmounted with a plume of long, brilliant feathers.—*La Nature.*

METEORIC DUST.—A metallic substance in powder or small granules has been sent to the *Science News* laboratory for examination. It proves to be meteoric dust, largely composed of iron, nickel, and silica. Dr. Batchelder, of Pelham, N. H., who sent the specimen, states that he collected the dust on the walk in front of his house after a smart thunder shower. It is probable that large quantities of this material fall upon the earth, but remain unnoticed. Much of the iron found in soils is due to precipitation from interstellar spaces, the particles becoming entangled in our atmosphere.—*Pop. Sci. News.*

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Durable Timber.

One of the properties conducive to durability in timber is its odoriferousness; woods which are so being chiefly the most durable. Close and compact woods, which make the most charcoal, are more permanent than open and porous qualities. The chestnut has rather more carbonaceous matter than oak, and, therefore, by reason of it, is more durable. Experiment has, however, shown the error of relying too much on these broad theories. One writer alludes to an experiment made to determine the comparative durability of woods. Planks of trees 1½ inches thick, of from 30 to 45 years' growth, were exposed to the weather 10 years. Cedar and chestnut were perfectly sound, spruce and fir sound, larch sound in heart, silver fir in decay, Scotch fir decayed, beech sound, walnut in decay, sycamore much decayed, birch quite rotten.

We must accept even these facts with caution. The questions whether the planks had been cut the same length of time, how they had been dried or seasoned, and the position they had occupied, are pertinent to the inquiry. The same wood often shows varying degrees of durability, owing to the position of the tree. If grown in moist and shady parts, the wood is inferior to that which grows in an exposed situation open to the sun and air. Some timber is more durable in wet ground or immersed in water; such are elm, beech, alder; while others, such as ash, oak, and fir, are more durable in dry situations. The increase in strength due to seasoning of different woods is given as follows: White pine, 9 per cent; elm, 12·3 per cent; oak, 26·6 per cent; ash, 44·7 per cent; beech, 61·9 per cent.

The comparative value of different woods, showing their crushing strength and stiffness, is: Teak, 6,555; English oak, 4,074; ash, 3,571; elm, 3,468; beech, 3,079; mahogany, 2,571; spruce, 2,522; yellow pine, 2,193; sycamore, 1,833; cedar, 700.

Regarding the relative degrees of hardness, shell-bark hickory stands highest; calling that 100, white oak is 84; white ash, 77; dogwood, 75; scrub oak, 73; white hazel, 72; apple, 70; red oak, 69; beech, 65; black walnut, 65; yellow oak, 60; white elm, 58; hard maple, 56; wild cedar, 55; yellow pine, 54; chestnut, 52; white pine, 30.

For furniture, hard birch, ebony, mahogany, maple, sycamore, and walnut are commonly used; while for turnery, acacia, hard hawthorn, holly, hard laurel, lignum vitæ, poplar, sassafras, sycamore, and yew are employed. For very great hardness, ironwood, hornbeam, almond, hard beech, teak, thorn, are serviceable. Myrtle, lime, box, olive, pear-tree, sycamore, kauri wood, pine, and holly are also very even, close grained, and hard.—*Building News.*

Electric Cables.

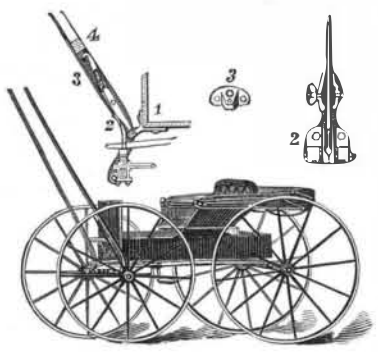
The attempts which are made to devise a practical and cheap system of undergound telegraphs continue to be numerous, but the actual progress which is made is not very marked. A history of underground telegraphs would indeed be a long list of failures, commencing in 1837 with the so-called "fossil" telegraph of Wheatstone, which consisted of bare wires placed in grooves in lengths of oak scantling. Most of these failures have not been due so much to actual defects in the inventions as to the inability of the inventors to push their commodities, owing to force of circumstances. The use of gutta percha shows no signs of falling off, and no substance has yet been brought into the market which has been proved to be a substitute for it.

Great attention is now being paid, says the *Electrical Review* (London), to lead-covered cables, the insulation of the latter, as in the Berthoud-Borel system, being due to resinous substances, which are far cheaper than gutta percha. Provided the lead covering remains intact, there is no reason whatever why such cables should not remain good for an indefinite period. In certain soils lead is practically imperishable; but, again, where clay is present, rapid decay occurs. About ten years ago a cable consisting of a cotton-covered wire placed in a lead pipe, the latter being filled with paraffine wax, was laid in Windsor Park in a clay soil; in a very short time this line became defective, and on examination it was found that the lead covering had been eaten into holes, which, by admitting moisture, rendered the wire useless; in this case the paraffine wax was not able to effectually coat the copper core. Excellent as paraffine wax is as an insulator, it has the great defect that it shrinks very considerably on cooling, and is therefore extremely liable to crack; indeed, most substances of this nature possess this element of uncertainty, and when used as insulators they practically can only be relied upon as "separators" to prevent metallic contact between a number of wires, or between the latter and a metal sheathing, the sheathing being the medium which keeps moisture out.

Lead, as a protecting covering, necessarily means considerable weight, and as a means of preserving single wires could hardly be adopted to any great extent. Multiple cables would have more chance of success, though the fact that the units of which they are built up are practically inseparable is a disadvantage; and, moreover, if moisture does penetrate, it means that nearly all, if not all, the wires will become defective. For very special purposes, however, the lead-covered cables should prove to be all that can be desired. The use of paraffine oil as an insulator in the Brooks system has yielded excellent results, and is an undoubted success, but we are inclined think that more satisfactory results might be obtained from a semi-fluid material, *i. e.*, one which would not be liable to become dispersed by leakage; but which would at the same time have the property of settling down if by any chance it were disturbed, and thus sealing up accidental faults. There seems at present but little chance of India rubber or gutta percha being superseded for submarine purposes, but the employment of a cheap yet efficient substitute for either of these materials would probably give a renewed impulse to such telegraphy, and would richly reward the inventor.

IMPROVED SHAFT SUPPORT.

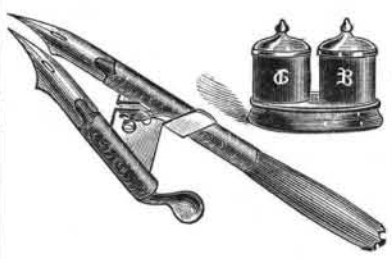
Attached to the forward part of the body of the vehicle is an angle plate or casting, from the outer angle of which project two lugs, between which the end of the fork is bolted. The plate may be secured to the center of the front of the body or to one corner, and can be fitted to vehicles having bodies of different forms. Each shank of the fork—shown detached in Fig. 2—is provided with a bend forming a recess for receiving clamping plates which have their adjoining faces serrated. A right and left hand screw is passed through the plates, between which is held a longitudinally slotted bar serrated on both sides to correspond with the serrations on the plates. The free end of the bar is formed with a downwardly projecting hook. When the shafts are to be held in a raised position, this hook enters a pocket (Fig. 3) secured to the shafts. The fork is pressed upward by a powerful spring, one end of which is held between the lugs projecting from the angle plate, while the other end bears against the under side of the fork. The length of the shaft support can be varied by moving the slotted bar in or out, the latter being firmly held in any desired position by the clamping plates. When not in use, the support is held in a vertical position in front of the dash board.



This invention has been patented by Mr. James F. Pace, and particulars can be obtained from from Messrs. Pace & Feibleman, of Simsboro. La.

AUTOMATIC DOUBLE-POINTED PEN HOLDER.

The pen herewith illustrated is specially adapted to the use of bankers, architects, bookkeepers, etc., and with it two lines can be ruled at once with different colored inks. Although expressly designed for ruling purposes, it gives most satisfactory results when used for ornamental or fancy writing. From the side of each holder projects a plate, the ends of the plates being pivoted together. Each of the adjoining ends of the plates is formed with an ear, one of which is apertured and threaded to receive a set screw, by means of which the pens can be adjusted to rule lines of any desired distance apart up to three-quarters of an inch. The pen holders are held pressed toward each other by a spring that permits the writer to separate the pens and take ink as quickly as with the common pen. Any kind or size of gold or steel pen can be used.



The inventor and manufacturer of this pen holder, Mr. C. R. Arnold, of Wellsville, Ohio, has designed a two-well inkstand, shown in the engraving, and a three-fourths-round ruler for use with the holder. Most favorable testimonials have been received from those who have used these holders.

Pyronaphtha.

According to the *Organ fur Oelhandel*, an interesting trial was lately made in St. Petersburg with a new illuminating material, which is destined, it is considered, to take the place of kerosene. This is a new illuminating oil, absolutely free from danger of fire. An experiment was made as to the power which pyronaphtha has of extinguishing fire; and it was found that burning kerosene was easily put out by it. Pyronaphtha can, however, itself be extinguished by water. It is a product of the distillation of naphtha residue, of which large quantities remain from the Baku distillation of petroleum. From these illuminating gas is produced, and likewise pyronaphtha. The idea would seem to have hitherto been carried out only by the firm of Ragosin & Co., of Baku. The celebrated Russian chemist, Prof. Beilstein, has examined pyronaphtha, and has expressed his conviction that it has a brilliant future before it, and that it must eventually replace American and Russian kerosene. The specific gravity of pyronaphtha is 0·864, and it ignites only at 230° Fah. It burns without smoke and vapor at 257°; gives a better light than kerosene; is consumed less rapidly; while its prime cost is less. At St. Petersburg it is being adopted for domestic use; and a special burner has been constructed for the purpose.

Habits of the Scorpion.

A writer in *Land and Water* relates his experience with scorpions as follows:

A few years ago, while in the island of Jamaica, it was my fortunate chance to have an opportunity of observing some very curious facts in connection with that genus of the Arachnida class commonly known as the scorpion, and the curious traits of character in these insects. Turning over some old papers in my office one day, I suddenly came upon a large black scorpion, who promptly tried to beat a precipitate retreat. Having read or heard somewhere that if you blow on a scorpion he will not move, I tried the experiment, and was greatly astonished to find that it had the desired effect. The scorpion stopped instantly, flattened himself close to the paper on which he had been running, and had all the appearance of "holding on" for dear life. While I continued to blow even quite lightly he refused to move, though I pushed him with a pencil and shook the paper to which he clung so tenaciously. Directly I ceased blowing he advanced cautiously, only to stop again at the slightest breath. I was thus able to secure him in a glass tumbler which happened to be within reach, and then I determined to try another experiment as to the suicidal tendencies which I had heard ran in the veins of the Pedipalpi family.

On the stone floor of the kitchen attached to my office I arranged a circle of burning sticks about three yards in circumference, the sticks being so placed that though there were no means of exit through the fire, it was not intense, but small and quite bearable as regards heat within a few inches, so that the central part of the circle was perfectly cool. Into this center I accordingly dropped my scorpion, who, on touching *terra firma*, darted off in a great hurry, only to be quickly brought to a halt on reaching within a few inches of the periphery of the circle. After a short pause of reflection he deviated to the right, and ran once completely round the circle as near to the fire sticks as it was prudent to venture. This he did three times, often approaching the burning sticks quite closely in his anxious endeavors to escape. In about a quarter of an hour, finding that his efforts were useless, he retired almost into the exact center of the circle, and there in a tragic manner raised his tail till the sting or spur was close to his head, gave himself two deliberate prods in the back of the neck, and thus miserably perished by his own hand. As I placed the body of the suicide in a bottle of spirits, I almost regretted that I had not let him escape before he had resorted to such an extreme measure.

My last experience is even more curious than the preceding, as it shows a remarkable provision of nature that is almost incredible. All I have ever read on this point is contained in the following words:

"The young scorpions are produced at various intervals, and are carried by the parent for several days upon her back, during which time she never leaves her retreat."

I was playing a game of billiards in a small village in the Blue Mountains; there was no ceiling to the room, the roof being covered, as is the universal custom in Jamaica, with cedar wood shingles. My opponent was smoking a large pipe, and suddenly, just as I was about to play a stroke, what I thought was the contents of my friend's pipe fell on the table close to the ball at which I was aiming. Instinctively I was on the point of brushing it off with my hand, when, to my amazement, I saw it was a moving mass, which on closer inspection turned out to be a very large female specimen of a scorpion, from which ran away in every direction a number of perfectly formed little scorpions about a quarter of an inch in length. The mother scorpion lay dying upon the billiard cloth, and soon ended her feeble struggles, the whole of her back eaten out by her own offspring, of which as they could not escape over the raised edge of the billiard table, we killed the astonishing number of thirty-eight. They had not only been "carried by their parent," but they had lived on her, cleaning out her body from the shell of her back, so that she looked like an inverted cooked crab from which the edible portions have been removed. She had clung to her retreat in the shingled roof until near the approach of death, when she had fallen and given us this curious spectacle. I was told by the attendant that the young scorpions always live thus at the expense of their mother's life, and that by the time her strength is exhausted the horrid offspring are ready to shift for themselves.

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