The Cocoon of a Spider.

At a recent meeting of the Academy of Natural Sciences, of Philadelphia, Dr. H. C. McCook stated that, while walking in the suburbs of Philadelphia lately, he had found under a stone a female Lycosa, probably L. riparia Hentz, which he placed in a jar partly filled with dry earth. For two days the spider remained on the surface of the soil, nearly inactive. The earth was then moistened, whereupon she immediately began to dig, continuing until she had made a cavity about one inch in depth. The top was then carefully covered over with a tolerably closely woven sheet of white spinning work, so that the spider was entirely shut in. This cavity was fortunately made against the glass side of the jar, and the movements of the inmate were thus exposed to view. Shortly after the cave was covered the spider was seen working upon a circular cushion of beautiful white silk about three-fourths of an inch in diameter, which was spun upward in a nearly perpendicular position against the earthen wall of the cave. The cushion looked so much like the cocoon of the common tube weaver, Agalena naevia, and the whole operations of the lycosid were so like those of that species when cocooning, that it was momentarily supposed that a mistake in determination had been made.

After the lapse of half an hour, it was found that the spider had oviposited against the central part of the cushion, and was then engaged in inclosing the hemispherical egg-mass with a silken envelope. The mode of spinning was as follows: the feet clasped the circumference of the cushion, and the body of the animal was slowly revolved; the abdomen, now greatly reduced in size by the extrusion of the eggs, was lifted up, thus drawing short loops of silk from the expanded spinnerets, which, when the abdomen was dropped again, contracted, and left a flossy curl of silk at the point of attachment. The abdomen was also swayed backward and forward, the filaments from the spinnerets following the motion as the spider turned, and thus an even thickness of silk was laid upon the eggs. The same behavior marked the spinning of the cushion, in the middle of which the eggs had been deposited. The ideas of the observer as to the cocooning habits of Lycosa were very much confused by an observation so opposed to the universal experience. Upon resuming the study after the lapse of an hour and a half, he was once more assured of being right by the sight of a round silken ball dangling from the apex of the spider's abdomen, held fast by a short thread to the spinnerets. The cushion, however, had disappeared. The mystery, as it had seemed, was solved; the lycosid, after having placed her eggs in the center of the silken cushion and covered them over, had gathered up the edges, and so united and rolled them as to make the normal globular cocoon of her genus, which she at once tucked under her abdomen in the usual way.

This was a most interesting observation, which Dr. McCook believed had not before been made. The manner of fabrication of the cocoon of Lycosa had been heretofore unknown to him, and, by reason of her subterranean habit, the opportunity to observe it was of rare occurrence. He had often wondered how the round egg-ball was put together, and the mechanical ingenuity and simplicity of the method were now apparent. The period consumed in the whole act of cocooning was less than four hours; the act of ovipositing took less than half an hour. Shortly after the egg-sac was finished, the mother cut her way out of the silken cover. She had evidently thus secluded herself for the purpose of spinning her cocoon.

Dr. McCook also alluded to another interesting fact in the life history of the Lycosa, which had been brought to his attention by Mr. Alan Gentry. A slab of ice having been cut from the frozen surface of a pond about eight or ten feet from the bank, several spiders were observed running about in the water. They were passing underneath the surface, between certain water plants. It is remarkable to find these creatures thus living in full health and activity in mid-winter, within the waters of a frozen pond, and so far from the bank in which the burrows of their congeners are commonly found. It has been believed heretofore, and doubtless it is generally true, that the lycosids winter in deep burrows in the ground, sealed up tightly to maintain a higher temperature.

Golden Streets.

The well known French electrician, M. Louis Maiche, has found that there is gold to be obtained from the quartz with which the roads round Paris are paved. M. Maiche has extracted small quantities of the precious metal by crushing the stone and treating it with mercury. We have not yet heard of the formation of a company for working the streets of Paris to obtain this gold, nor do we suppose that there will be much of a rush for the new "diggings."

EVEN delirium tremens is now traced to a micrococcus: "the worm of the still."

ELECTRICITY WITHOUT APPARATUS.

(1) To produce an electric spark, it is only necessary to warm a sheet of ordinary paper in front of a good fire or stove or over a lamp. Upon going into a dark place and applying the knuckle to the paper a very decided spark will start from the latter, accompanied by a slight crackling sound.

(2) Take two sheets of paper and interpose a sheet of gold-leaf between them. After electrifying them as above described, it will be only necessary to pass a pencil point in a zigzag manner over their surface to cause the appearance thereon of a luminous flash of considerable intensity.

AN ELECTRIC SPARK FROM A SHEET OF PAPER.

These experiments, which are very easy to perform, may serve to demonstrate the fundamental rules of static electricity to children.

Fireproof Paper.

A fireproof paper is made by a combination of asbestos and infusorial earth.

About forty parts, in bulk, of fine or disintegrated asbestos fiber and about sixty parts of what is known as "infusorial earth" are taken and placed in a dry state in an ordinary beating engine, and then sufficient water is added while the machine is in operation to beat the mass into pulp just thin enough to form upon an ordinary cylinder. The web is taken from the cylinder and finished in the usual manner. The asbestos fiber is long enough to give strength and elasticity to the paper, and the infusorial earth, which is a good non-conductor of heat, and fireproof, forms a filler or padding, the two adhering together strongly and forming a flexible paper, which may be used wherever ordinary paper board is employed, it differing, however, from ordinary board in being fireproof.

The infusorial earth should be calcined before use to free it from impurities not fireproof.

If desired, and in some instances, a small quantity of lime, starch, or other cementitious substance is added. The proportion of asbestos and infusorial earth may be varied.

THE TARANTULA OF SOUTHERN CALIFORNIA.

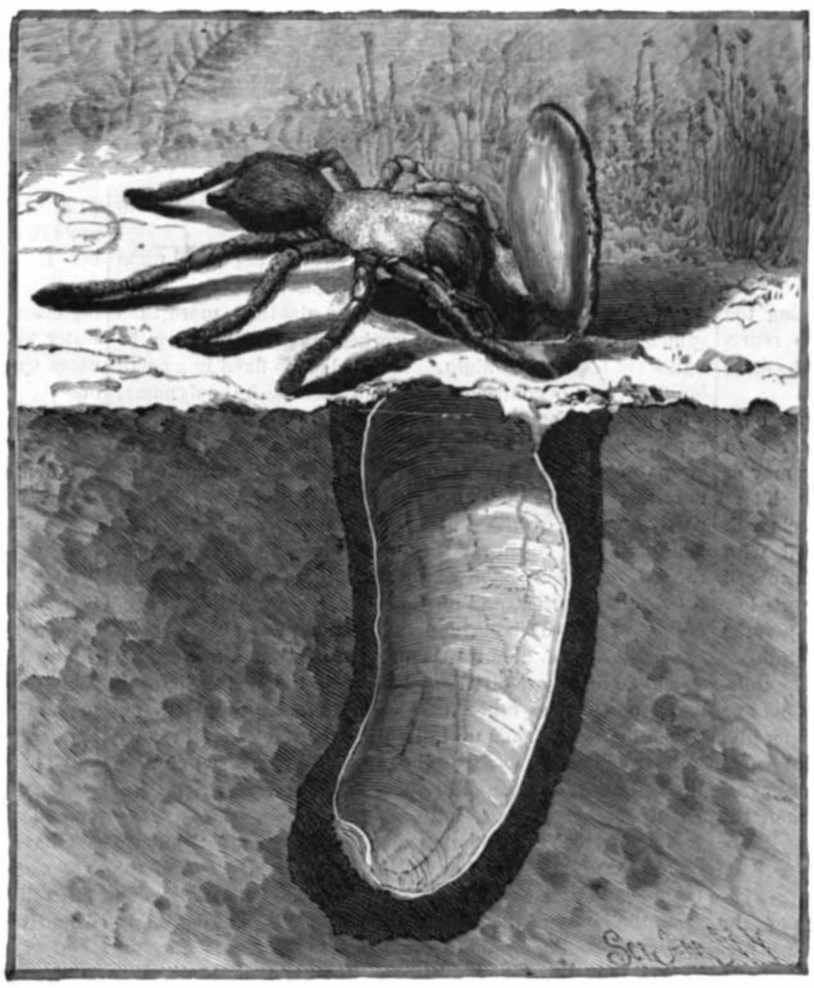
Ugly, vicious, energetic, and to a certain degree poisonous, are the spiders that infest the southern part of California, and yet when closely studied they present many peculiar characteristics, both in regard to their structure and habits. Among the most valued trophies tourists carry away with them from the coast are neat cards adorned with these animals, and a case containing the nest so arranged as to show it wonderful trap door and the delicate lining of the interior. The adobe ranches are full of these strange little habitations, and some of the sunny valleys among the foot hills are literally strewn with the small tunnels, capped with the almost invisible door. Our engraving shows the tarantula (*Mygale hentzii*) as he is about to enter his abode, both being full size.

The general appearance of the tarantula is very clearly shown in the engraving. The legs are larger, and are not furnished with so long and dense a growth of hair as are the specimens found in other sections of the Southwestern States. The back is covered very thickly with extremely fine short hair; the back and the outer joints of the legs are of a light brown color, the remainder being of a deeper shade. The forward part of the head is divided, and each division terminates in a sharp, downwardly curved, and jet black horn or hook.

The tarantula pounces upon his prey, and thrusting in the hooks most securely holds his victim. It is seldom met in the daytime, preferring to seek its food during the night, returning to its nest in the early morning. Although pugnacious when cornered, he will not seek a fight, and is more anxious to escape than the stranger whom he chances to meet.

This tarantula is justly celebrated for the architectual skill he displays and for the luxurious comfort of his dwelling. Having selected a suitable site, he digs a hole varying from four to eighteen inches in depth, and just large enough around to admit him easily, although it is puzzling to conceive how he ever gets his long, ungainly, and many jointed legs comfortably disposed in so small a space.

The walls are carefully smoothed, and are completely covered with an exceedingly fine fabric of his own manufacture. The top of this tunnel is slightly flared, and in this widened part is fitted the door, which is hinged at one side so that it may be easily lifted. The inside of the door is finely finished, and covered with a web similar to that on the sides. The tarantula knows that this door is not heavy enough to insure a tight fit when it is dropped, so he makes a small handle near the center of the under side by which he pulls the door closely down, thereby insuring a joint that most effectually excludes all dampness from his abode. The handle is a strong web, the two ends of which are attached to the door at points about one-sixteenth of an inch apart. The outside of the door is placed about at the level of the ground, and is so nearly the same color as the surrounding soil that it can be discovered only after the most careful search. The joint of the door is so well made and the colors are so nearly alike that it is almost impossible to ascertain upon which side the hinge is placed, except by raising the door. The framing of the door seems to be a coarse, strong web, which is extended at one side to form the hinge, and which is bonded with earth to give it the requisite stiffness. The hinge is about three-eighths of an inch wide, and acts as a spring to shut the door immediately after the owner's exit. For the tarantula and nest from which our engraving was made, we are indebted to the courtesy of Mr. H. J. Finger, of Santa Barbara, Cal.



THE TARANTULA OF SOUTHERN CALIFORNIA.

Preparation of Aluminum.

According to an account which the SCIENTIFIC AMERICAN finds in *Chemiker Zeitung*, ferro-silicium is mixed with fluoride of aluminum in equal proportions, and the mixture is exposed to a fusing heat. The materials decompose each other, and volatile fluosilicium with iron and aluminum are produced, the latter two bodies being alloyed together. In order to extract the valuable aluminum, a copper alloy is formed by melting the iron alloy with metallic copper; by reason of the greater affinity of the copper for aluminum this is secured, leaving with the iron only a slight residue of aluminum. When the fused mass is cold, copper bronze and iron have so settled that both bodies can be easily separated. In place of the pure fluoride of aluminum, chloride can be used, when chlorsilicium and iron aluminum alloy are formed. If in practice the chemical reactions above outlined are found to hold true, this patented process promises to be of considerable value.

LARGE fortunes are rare in Switzerland, and the salaries of public functionaries very modest. The President of the Confederation receives $3,000 a year, few judges more than $1,250, and there is probably no bank manager in the country who gets more than twice that amount. A man with an income of $2,500 is considered very well off indeed, and to have $5,000 is to be rich.

"Crackle" Glass.

This variety of glass, which has become so fashionable on account of its effective and crackled appearance, is, according to the *Glassware Reporter,* very easily made.

It is produced by covering one side of a piece of plate glass with a thick stratum of a flux or readily fusible glass, mixed with coarse fragments of glass. In this condition it is placed in a muffle, or an open furnace, where it is strongly heated. As soon as the flux is melted and the glass itself has become red hot, it is removed from the furnace and rapidly cooled. The flux (or fusible glass), under this treatment, cracks and splits, leaving innumerable fine lines of fracture over its surface, having much the appearance of scales or irregular crystals, which cross and intersect each other in every direction, producing very striking and beautiful effects when the light falls upon its surface.

The rapid cooling of the fusible coating is effected either be exposing the heated mass to the action of a current of cold air, or by cautious sprinkling with cold water.

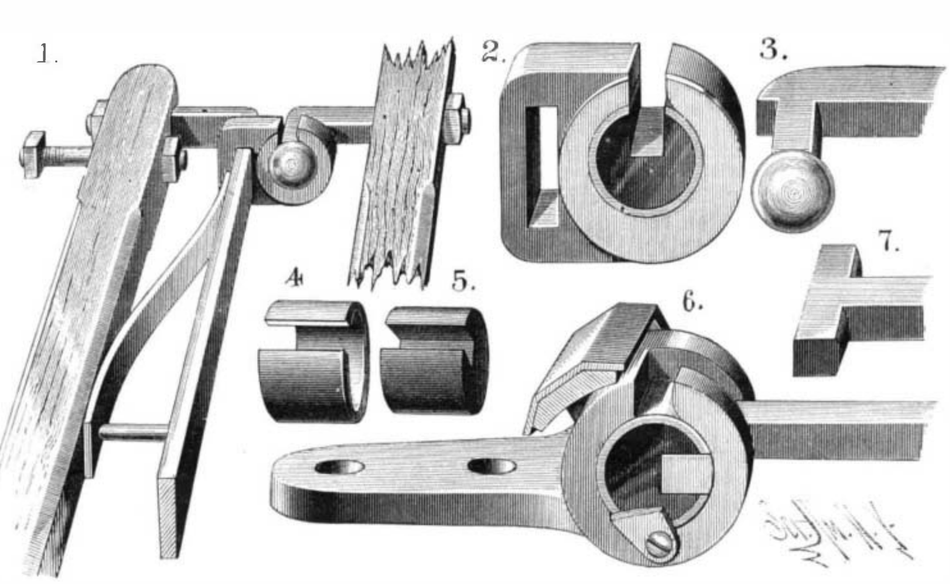
By protecting certain portions of the glass surface from the action of the flux, these portions retain their original smoothness and polish, and form a striking contrast to the crackled portions of the surface. By this means inscriptions or decorative designs of every description are produced upon a colorless or colored ground.

A modification of this method of producing crackle glass is the following: A coarsely granular flux is strewed upon the surface of a glass cylinder, while the latter is red hot, until the flux melts. It is then removed and rapidly cooled either by the use of water or by waving it about in the air. The stratum of melted flux is then caused to crack as above described. The cylinder is then cut, flattened, and brought to a level surface in the usual manner.

IMPROVED THILL COUPLING.

Our engravings show the various parts of a thill coupling, for which letters patent have been obtained by H. M. Wheeler, M.D., of Grand Forks, D. T. It is so made as to prevent all rattling, is strong and secure, and the change from thills to pole, or *vice versa,* can be effected in a very short time. Fig. 2 is a perspective view of the knuckle used on cutters; it is made of casehardened malleable iron, and is formed with a rectangular transverse slot and a circular transverse opening, the lower part of the forward wall being cut away to form a bevel. Within this opening is placed the incomplete metal ring, Fig. 4, which in turn receives the rubber packing, Fig. 5. In Fig. 3 is shown the L-shaped head, in which the thill or pole straps terminate, and Fig. 1 illustrates the application of the coupling to cutters. The heads are movable upon a flat iron bar which replaces the round rod ordinarily used in cutters, and which enters the transverse slot. The draw-heads are governed by springs as in other cutters, insuring side or central draught and giving the proper position for the pole when both springs are in use. Thills or pole to be inserted are placed in a vertical position, and the horizontal part of the head enters the slots and passes down into the recess in the rubber packing. They are then brought down into a horizontal position, the bevel serving to drive the metal into the rubber—the groove in the rubber being too shallow to receive it without pressure. Fig. 2 also represents, with slight alterations as to attachment to the axle, couplings for light buggies.

In the coupling, Figs. 6 and 7, designed for heavier buggies and road wagons, the draw-head is much wider than the one above described, and the circular opening may or may not extend through the head. The transverse slot at the top extends two-thirds across the top and intersects with a vertical slot. A cap or cover which is cushioned with rubber, is secured with rivets as indicated, and when turned back it permits the T-shaped head, Fig. 7, to be inserted or removed, and when turned completely forward it permits the removal of the metal cylinder. The two couplings, comprising the pair, work from the same side. The thills are placed vertically, the T beads inserted in the slots and pressed into the rubbers when they are moved laterally, until the stem of the head is opposite the vertical slot, when they are brought down to a horizontal position. The covers are then adjusted, and held in place by the friction of the rubber cushion.



WHEELER'S IMPROVED THILL COUPLING.

The Use of Old Muskets.

An exchange says that the condemned muskets of the Government—the Enfield and Belgian rifles and other firearms of the late war—find purchasers among Grand Army posts, amateur military companies, and speculators for foreign markets, some of them being converted into breech loaders for sporting purposes.

There is still another demand for them which is not generally known. Large numbers of smoothbore musket barrels are remounted and restocked, and are highly valued as duck guns and for other field sporting purposes, even without being converted into breech loaders. A sportsman, who is a very successful hunter, said recently that an old musket barrel restocked was his most valuable gun, and yet cost him only $8, and he has in his collection several of the most costly breech loading "stub and twist" guns, worth $100, more or less, each.

But whatever may be the value of these gun barrels, it is certain that a very large number find their way into the market as sporting guns. A gunsmith with an experience of twenty-five or thirty years lately answered, in response to an inquiry, that a very large proportion of his business was the alteration and remounting of old military gun barrels, which form a considerable portion of the sporting gun seller's stock in trade. The cost of these guns is very slight, and their market price brings them within the reach of most purchasers. But a gun with real twist barrel is a costly article. Instead of being rolled from a plate or "skelp" between grooved rollers and welded at one rapid operation, it is patiently hammered into a cylinder by hand. The mottled, damascened, or striated appearance is produced by a series of wires of differing irons twisted into cables and then welded into square rods. These placed side by side and heated to a weld are wound a half turn, or perhaps more, at a time on a mandrel, and seated (welded) against one another by repeated taps of a light hammer. The ribbon thus formed of cables of fine wire may consist of not less than thirty-six or even fifty-two strands of wire.

The Electric Light for Country Houses.

A very pleasing example of electric lighting for country dwellings is described in *The Architect* as having been introduced at Linden Park, near Hawick, N. B., the residence of Mr. Walter Laing. A small stream runs through the grounds, and advantage has been taken of this to obtain power for producing electricity for lighting the mansion and stables. A turbine wheel has been erected capable of giving off about eight horse-power, and requiring about 270 cubic feet of water per minute when working at full power. As the stream will not in dry weather give nearly so much as this, a reservoir, in the shape of a small lake of about an acre in extent, has been constructed in the bed of the rivulet.

In the driest weather the stream may be depended upon to give at least 80 cubic feet per minute, and this being stored up in the reservoir during the daytime, more than sufficient force is obtained for working the turbine when the lights are required at night. The turbine is fixed in a small building, and is connected by a short belt with the dynamo, which is a Siemens compound self-regulating machine, capable of supplying about seventy "Swan" incandescent lamps of 16 candle-power each. From the dynamo the necessary conducting wires are carried up to the house, partly on posts overhead and partly underground, branches being taken off to supply the stables and the avenue from the lodge. About 100 Swan incandescent lamps have been fitted up altogether, and of these 70 can be worked at once, and all or any can be turned on or off at pleasure. Most of the lights are of about 16-candle power, but a few are 32. About 80 lights are distributed through the house, lighting every portion, no other kind of light being provided for. Seven lights are taken up in lighting the stables, and twelve outside. These latter are all controlled by one switch near the hall door, and can either be lighted or extinguished instantly.

The effect of the instantaneous lighting up of the drive on a dark night is novel and pleasing. The distance of the turbine and dynamo from the house is about 350 yards, and from the house to the lodge about 400 yards, so that a circuit approaching a mile in extent has to be traversed by the electric current which goes to the farthest lamp. Very little attendance is required by the dynamo machine or turbine, all that is necessary being to turn on the sluice valve admitting the water to the turbine when the lights are required, and it is only necessary for a man to inspect the machines about once in the evening.

For stopping the turbine at night when the lights are no longer required a simple electrical arrangement has been designed, by means of which the sluice valve can be closed from the house without going down to the turbine house. This is done by merely touching a handle, and so admits of the lights being burned late, and put out at any time without the necessity of keeping any one in attendance to turn off the water when done with. The steadiness of the lights is absolutely perfect, and there are no products of combustion whatever given off to contaminate the air of the room and spoil the decorations.

Natural Gas Fuel at Pittsburg, Pa.

At the recent meeting of the American Society of Mechanical Engineers at Pittsburg, the report of the committee appointed to investigate the whole subject of natural gas was made, and many interesting particulars given.

Though Pittsburg is within reach of three or four prolific localities, and gas has been used for many years, it is but recently that any organized effort has been made to use it on a large scale. Already there are a hundred and fifty companies chartered in the State, representing over two million dollars; and gas is brought from eight to twenty five miles for use in the city. Five-inch mains are being followed by eight-inch, new wells are being bored, and the time when Pittsburg shall become a smokeless city may not be far distant. Though the gas is used under a pressure of a few ounces, the pressures at the wells run from fifty to a hundred and twenty five pounds; this is due to the friction in the mains, five pounds being allowed for each mile. If the flow be shut off the pressure runs up much higher, and great difficulty has been experienced in making tight joints; cast iron is too porous, and ordinary pipe threads do not fit well enough. A number of new coupling devices were exhibited, in some of which a lead packing was used. No allowance for expansion need be made, as the gas maintains an even temperature of about 45° Fah. When gas is allowed to burn freely at the mouth of a well, the cold produced by the expansion is such that ice has been projected through the flames.

The gas is used in all kinds of furnaces for making steam, iron, glass, etc.; and electric light carbons, and the finest lampblack for printing inks, are made from it; but it is used with suicidal wastefulness, which causes anxiety, as many wells give out in less than five years. The report looks to its economic and safe control. For household use it might otherwise be dangerous; and such use has commenced, though no practicable method of deodorizing it has been found. Being composed largely (ninety-six per cent) of marsh gas, its value as a heating agent is high, and its density is about half that of air. One pound (23·5 cubic feet) of gas has a theoretical evaporating power of twenty-four pounds of water, twenty pounds having been actually evaporated. The best method of burning it is not generally known; experiments with injector burners show that they do not suck in sufficient air for complete combustion, and the best results have been from numerous jets in contact with the whole heating surface of the boiler. The value of the gas, as compared by evaporation tests with coal at $1.40 per ton, is only eight cents per thousand feet (which suggests that even our ordinary gas companies make profits), but its use is immensely more convenient; no stacks are needed, and the furnace reduces to a simple non-conducting chamber. The gas has just been turned on to the city water works. On the first day's excursion numerous furnaces were seen running with gas blown in through rough, one-eighth inch nozzles; and two or three lines of five-inch pipe lay on the surface of the railway embankment.

A gas well has lately been opened within the city limits, at a depth of 1,600 feet, on the property of Mr. Westinghouse.

Length of Our Lives Increasing.

At a recent international health exhibition held in London, Sir James Paget delivered an address before the association, the Prince of Wales being present.

The learned physician asserted that people live longer than formerly, and that less sickness prevails among the mass of people, and he then gives the following reasons for the decrease of mortality during the last few years:

"There is less from intemperance, less from immorality; we have better, cheaper, and more various food; far more and cheaper clothing; far more and healthier recreations. We have on the whole better houses and better drains, better water and air, and better ways of using them. The care and skill with which the sick are treated in hospitals, infirmaries, and even in private houses are far greater than they were; the improvement and extension of nursing are more than can be described; the care which the rich bestow on the poor, whom they visit in their own homes, is every day saving health and life; and even more effectual than any of these is the work done by the medical officers of health and all the sanitary authorities now active and influential in every part of the kingdom. But we want," adds the lecturer in closing, "more ambition for health—a personal ambition for renown in health as keen as is that for bravery or for beauty, or for success in our athletic games and field sports."