Correspondence.

Meteor at Ogdensburg, N. Y.

To the Editor of the Scientific American:

Friday afternoon, October 20, in the vicinity of 5:20 o'clock, a brilliant meteor passed across the sky. I first noticed it nearly overhead, perhaps a trifle east of the meridian, and moving in southerly direction, or a little east of south, I should judge.

Although it was daylight, the meteor appeared larger and fully as bright as Jupiter does in the evening.

It had a pointed "tail" or train, apparently three or four times as long as its diameter, which looked like a flame, partly broken up by particles or sparks.

I send this, as perhaps you will hear of this traveler from other parts of the country. R.

Ogdensburg, N. Y., October 21, 1893.

Home-made Storage Batteries.

To the Editor of the Scientific American:

An article appeared in the SCIENTIFIC AMERICAN of this year describing the manufacture of a storage battery that induced me to undertake the manufacture of one, and perhaps the many readers of your valuable paper would like to know how I succeeded.

I made two cells, each composed of eight 6 by 8 plates. I rolled my plates out of old tea lead melted into a bar. This lead is remarkably pure and soft, and easily worked. I roughened the plates and coated them with red lead made into a paste with water, and when they were dry I wrapped them with strips of muslin to hold red lead in place until it could be reduced in the "formation." I did not use sulphuric acid to mix red lead with, as it is not necessary and is bad for hands and clothes.

I used ordinary gravity glass jars for my cells and connected the cells in series, using a ten per cent solution of sulphuric acid (commercial) by measure. I charged the two cells at once by a current from six cells of gravity battery, arranged in series. Charged for eight hours and then discharged storage cells through ten ohms resistance. Then charged in opposite direction and discharged through resistance again; then kept charging and discharging in opposite directions for about ten days, when the cells were in good condition. I never have used more than six gravity cells to charge with and now keep charging current on all the time.

I use the cells to actuate my dental mouth lamp and plugger, and am making a motor to run my dental engine. The current from the two cells is strong enough to melt four inches of No. 20 iron wire and heats a platinum cautery wire white hot.

The manufacture and charging of a storage battery presents no difficulties, and its efficiency and power are remarkable, making it "the battery" par excellence.

Palmer, Neb., October 9, 1893. M.

Instantaneous Photography.

BY CAPTAIN W. DE W. ABNEY, C.B., D.C.L., F.R.S.

If any point in an object is represented by a disk about $\frac{1}{100}$ of an inch in diameter, it is sharp to the eye. If, therefore, all movement of the object can in the image be confined to this amount, it will appear sharp. Now, with a hand camera, the focus of the lens is usually about 5½ inches—let us say 6 inches. At 50 feet off, therefore, an object may move through 1 inch and still appear sharp—that is, the motion during the time of exposure may be that amount. Say that the time of exposure is $\frac{1}{50}$ second, it is evident that the object at 50 feet off may move at the rate of 50 inches—say 4 feet—a second to fulfill the conditions. Now, a man may walk two steps of 2½ feet each in a second, and supposing he moves uniformly across the view, he would just move a *little* too quickly. Let him be 100 feet away, and he would be well within the limit laid down. If he were approaching or receding from the camera, of course the circumstances are changed, and the movement he makes in regard to the plate would be a slight up-and-down motion, and no movement would be perceived until he was quite close to the operator.

Let us take another example--an express train going about 40 miles an hour. During 1 second it moves about 60 feet. If it be desired to take this at a distance of 100 feet away while rushing across the field of view, it is not hard to see that a movement of 60 feet would require a rapidity of exposure of $\frac{1}{750}$ of a second. If it be taken at a distance of 750 feet, it would fulfill the required condition with an exposure of $\frac{1}{50}$ of a second. Express trains have been taken, but as a rule they are coming in a marked degree toward the operator, which immensely reduces the apparent motion. The motion of a breaking wave is small comparatively, and it will be found that for pictures of this description $\frac{1}{10}$ second is not too small an exposure with a lens such as is used with a hand camera. It must not be inferred that this is recommended, but only that such can be given without any great loss of sharpness. For street views the shortness of exposure should only be limited by the rapidity of the plate and the ratio of the aperture of the stop to focal length that can be secured. There are scarcely any shutters which expose more rapidly than the $\frac{1}{60}$ of a second, though, of course, there are some; but none that the writer has used is less than the $\frac{1}{100}$ of a second, and this is a very rapid rate. This only applies to shutters at the lens itself, and not to those next the plate. These last can be made to expose any part of a plate to almost any small fraction of a second by narrowing the slit which passes across it.

When instantaneous views are taken with lenses of longer focus, of course the limit of motion in an object is narrowed down proportionally; that is to say, with a lens of 12 inches focus the distances given in the examples must be increased proportionally, or doubled. This shows that in the quarter-plate picture it is more easy to secure sharpness than in, say, a whole-plate picture, since the focal length of the latter is, as a rule, longer than that of the former.

We may as well give a rule to find what motion is allowable. Divide the distance of the moving object, in feet, by the focal length of the lens in feet, and divide the product by 100, and it will give the result in inches. Thus if an object is 90 feet away from the camera, and the focal length of the lens is 12 inches (or 1 foot), the object may move $\frac{90}{1}$ by $\frac{1}{100}$, or $\frac{9}{10}$ inch during exposure. To ascertain if the shutter is sufficiently rapid to be within the limit, divide the allowable movement in feet by the rate of movement in feet per second. Thus, with the above, if the object were moving 10 feet a second, the speed of shutter required would be $\frac{\frac{9}{10} \times \frac{1}{12}}{10} = \frac{9}{1200}$ of a second, or about $\frac{1}{130}$ of a second—a time too small for most shutters. If sharpness be required with a shutter exposing $\frac{1}{50}$ of a second, the object should be taken at $\frac{130}{50} \times 90$ feet, 234 feet off, or in round numbers 80 yards off.

English the World-Speech.

The advocates of English as the universal language have received a coadjutor from an unexpected quarter. There recently appeared in the *Preussische Jahrbuecher* an article from Dr. Schroer, advocating making the study of English obligatory in the schools. The reasons assigned for this are more interesting than the proposition itself. The need of a universal language has long been felt. The effort to introduce Volapuk was a recognition of this, but Dr. Schroer condemns any attempt to construct an artificial world-speech. A language, he says, without historical development, literature or linguistic relations will not be studied by any considerable number of people until it becomes universal, and hence it cannot become universal at all. This means that if we are to have a universal language it must be chosen from existing languages, and of course from the number of those that are widely diffused and spoken by great civilized nations.

Attempts to introduce artificial languages are not only hopeless, but they are unnecessary, for, says Dr. Schroer, there is already a universal language, and that is English. But in what sense is English a universal language? It is, says Dr. Schroer, one which, by its spread over the whole earth and by the ease with which it may be learned, has reached a position so far in advance of all others that neither natural nor artificial means can deprive it of its assured position as the future means of international intercourse. He, therefore, concludes that "the English language is the world-speech, and will, to all appearance, become more and more so every year."

This tribute to the English language is the more impressive because it emanates from one who has no bias in its favor from its being his mother tongue. The statements which he makes are fully borne out by facts. The language is spoken by the richest and most powerful commercial nation of Europe, in the greater part of North America, in the Sandwich Islands, India, South Africa and Australia. Since the beginning of the nineteenth century the number of English-speaking people has grown from 25,000,000 to 125,000,000. There is no prospect of any check to the progress of this triumphant tongue. It may be added that the study of English gives access to incomparably the richest literature in the world. Its claims to the primacy are so eminent and evident that even foreigners acknowledge them. It affords a practical and easy way to the attainment of the great desideratum of a universal language.—*Louisville Courier-Journal.*

Oil Versus Coal.

Mr. Stone Burbury, of Cowes, Isle of Wight, owner of the yacht Venture, which was fitted with steam machinery, has had this removed and replaced with an oil engine, made by Messrs. Vosper & Co., of Portsmouth. The vessel would not before steam against the strong tides in the Solent, but does so now with ease; she could also only conveniently carry sufficient coal for six hours, but is now fitted for running forty-eight hours. The oil tank is also placed in a space which was before quite useless, therefore taking up no available room.—*Industries.*

The Earth in Space.

There is a curious fascination in putting side by side the myth and science of astronomy. The old legends of the sun and moon, of earth and sky, of heaven and the stars, tell us of the selfsame objects whose place and size, whose weight and nature, astronomers are chronicling to-day. The difference is great indeed between the guesses of early times and the methods of modern science; nowhere else, perhaps, is the contrast seen so well between the infancy and the maturity of the mind of man, and no part of astronomy shows it so clearly as that which tells of the earth's place in the universe. To the Greeks, eight centuries before Christ, the earth was flat, surrounded by the sea, and covered by the canopy of sky, which is the floor of heaven, the abode of the Olympian gods. Greece was at the center of the earth, and Delphi at the central point of Greece. As to other worlds scattered through the sky depths, science has lately been learning much; something of their nature, their number, their distance is constantly being learned, while the way is being prepared for gaining some real insight into the relations of the stars among themselves, and for fixing our own position in regard to other suns and systems than our own.

We have to invent a new measure for talking of their distance, since, finding miles too small, we talk of "light years," which means the distance that a ray of light, traveling some hundred and eighty-six thousand miles a second, would traverse in a year. Before we get too used to talking of light years, it may be well to try to get a notion what a light year really is. It means a journey that would take an express more than eleven million years. It means a velocity that the periphery of a gigantic flywheel one hundred miles in diameter could not keep up with, though it made five hundred revolutions in a second. It means a distance traversed in one second that sound will not pass over in ten days. And this is the unit for the quantities that modern astronomy deals with when treating of the distribution of stars in space. Sometimes one hears a cubic light year spoken of; that is, an imaginary cube with each side a light year long. It was long after men saw how to measure the distance of the stars before they succeeded so as to feel much confidence in the results obtained; but now the distances of a few stars are known with comparative accuracy and certainty, many measures having been made that probably come within twenty or thirty per cent of the truth.

The nearest star that has been found is Alpha Centauri, with a distance of 4⅓ light years. Probably next in order is a small star, numbered 21,185 in Lalande's catalogue. It is about 6½ light years off, while 61 Cygni, the most frequently measured of any star, is about 7 to 7½ light years off. But let us take our nearest neighbor and try to see something of the isolation of our solar system in space. Let us try to conceive of a sphere of which the sun is center, with a radius of 4·35 light years, so placing our nearest stellar neighbor on its circumference—translated into the more familiar unit, its diameter is over fifty billion miles and its cubic contents nearly three hundred and fifty cubic light years, or seventy thousand sextillions (7 with 40 ciphers) of cubic miles, for a cubic light year is rather more than two hundred sextillion cubic miles. Here is isolation indeed. The sun, with all its vastness, does not fill one two hundred-thousand-trillionth (2 with 23 ciphers) part of the sphere that has our nearest stellar neighbor on its surface. The gigantic volume of the sun in such a space is like an isolated shot containing but one-half of a cubic inch immersed in the whole water of the sea, while a little speck, less than the two-millionth of a cubic inch, suspended in the three hundred and seventy-three trillion gallons of these a would represent the earth suspended in the sphere, the radius of which reaches only to the nearest star.

Did we set the pole star at the limits of our space sphere, the volume of the sphere would be three thousand times as great; and the sun must be thought of as occupying the six-thousandth part of an inch in the four hundred million cubic miles of sea. Were Vega, at a distance of ninety-six light years, on the boundary of our sphere, the space that reaches to our nearest neighbor must be increased ten thousand times in volume, and the earth becomes a difficult microscopic object in the vast abyss of sea. These are all stars whose distance has been measured with more or less accuracy; but there are other objects more remote that have defied all attempts to measure them—in literal fact, they are immeasurably remote distances. The figures given here to show the position of the earth in space are wholly paltry and inadequate compared with the (as yet) unknown reality. Much has been learned and the way prepared for yet greater advances. Man has dethroned himself from the chief position in the universe, has seen his world cease to be the center round which all else revolves; has recognized his abode as the tiniest imaginable speck in space; man—

Who sounds with a tiny plummet, who scans with a purblind eye,
The depths of that fathemless ocean, the wastes of that limitless sky

—yet has a longing to penetrate still farther through the star depths to win yet other secrets from the mysteries of space.—*Prof. Wm. Schooling, Knowledge.*

Willow Farming.

A new industry has been established in St. Louis county near the little town of Allenton, thirty-six miles west of the city of St. Louis, on the Missouri and Pacific and St. Louis and San Francisco railroads, which, if successful, will furnish employment to thousands of unemployed laborers. The enterprise is for the cultivation, on a large scale, of willows suitable for the manufacture of willow ware.

A description of the process through which the willow goes in its various stages of cultivation, harvesting and preparation for the factory, as given by the St. Louis *Globe-Democrat*, is interesting. The willow plant is obtained by cutting up live willow twigs twelve inches long. These are sharpened at one end and planted in rows by thrusting them into the ground to the depth of six or eight inches. As soon as the plants begin to sprout, the work of weeding and cultivating should begin and be kept up until the crop is laid by, the same as in the cultivation of corn. The canes ripen in the fall, when the frost strips them of the leaves and turns the bark a glossy brown color. When ripe, the willows are, under favorable circumstances, from ten to twelve feet in length. They are then cut and tied in bundles like rye, carted to the hothouses, where they are subjected to a sweating process, which softens and bleaches the bark, which is then easily peeled off by dragging them through a little machine made for the purpose. Another process is that of steaming the willows, which is much quicker, requiring only a few hours, while the former requires a month, but is not so desirable, as the willows are discolored to some extent and thus rendered less valuable for fine work.

The willow plants last about twelve years, after which they are grubbed up and the ground replanted. The plant does not attain its full growth until the second year, as the greatest part of its energy is spent the first year in making roots.

It is estimated that under the most unfavorable circumstances an acre of properly cultivated willows during the first three years will produce from 3,000 to 5,000 pounds of peeled willows, ready for market, the price of which is ten cents per pound, wholesale.

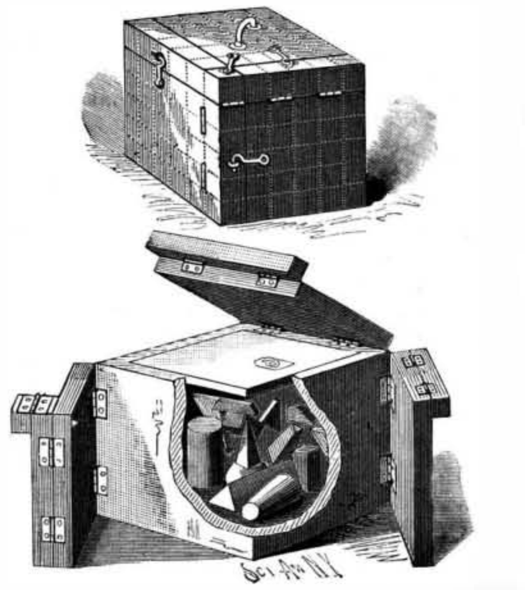
Taking the lowest estimate of the produce of one acre, 3,000 pounds, at the lowest market price, six cents, the marketable value of the product of one acre is $180. The cost of planting, including plants and labor, is $40 per acre. The highest estimated cost of cutting, hauling, steaming and peeling is about $50 per acre, making a total expense of $90 per acre, and leaving a profit of $90 per acre on the raw materials the first year.

AMERICAN HISTORICAL EXPOSITION IN MADRID.

A recent number of *La Ilustracion Espanola y Americana* pictures these vases, called *huacos*, on account of having been found in the *huacas* or Peruvian sepulchers. They were found in the necropolis of Gran Chimu. The reader will discover the strange resemblance which exists between the productions of the precolumbian civilization in America and that of oriental Asia, a resemblance that is recognized by all learned men, but has never been explained.

A GEOMETRICAL EDUCATIONAL APPLIANCE.

A device designed to facilitate the work of teachers of geometry, and which has been patented by Mr. Newton Z. Fulton, is represented in the accompanying illustration. It consists of a cubical shaped box of novel construction, and designed for use as a recepta-



FULTON'S CUBE BOXES FOR EDUCATIONAL PURPOSES.

cle for the various models of plane and solid geometric forms, such as cylinders, cones, cubes, pyramids, globes, squares, triangles, ellipses, parallelograms, etc. The top of the box proper is made to fit within its sides, so as to be flush with their upper edges, and it has a flush or non-projecting handle or pull. On the outer walls of three sides of the box are hinged sections which when folded form a perfect cube of larger size than the box, and the sides have also other hinged sections which, by being movable, may be used to illustrate the principles of square and cube root by the segregate character of the aliquot parts of a square or cube. The hinged sections are provided with locking devices, whereby all the parts are connected together and not liable to be detached and lost, and an external handle affords convenient means of carrying the box.

Further information relative to this improvement may be obtained of Mr. D. J. Splane, Crested Butte, Col.

How to Keep Cider Sweet.

Pure, sweet cider, that is arrested in the process of fermentation before it becomes acetic acid, or even alcohol, and with carbonic acid gas worked out, is one of the most delightful beverages. The following scientific method of treating cider will preserve its sweetness: When the saccharine matters by fermentation are being converted into alcohol, if a bent tube be inserted air tight into the bung, with the other end in a pail of water, to allow the carbonic acid gas evolved to pass off without admitting any air into the barrel, a beverage will be obtained that is fit nectar for the gods. A handy way is to fill your cask nearly up to the wooden faucet, when the cask is rolled so the bung is down. Get a common rubber tube and slip it over the end of the plug in the faucet, with the other end in the pail. Then turn the plug so the cider can have communication with the pail. After the water ceases to bubble, bottle or store away.

How Mail Clerks Assist the Memory.

The railway postal clerks have a unique method, says a contemporary, for learning the routes on which post offices are located. Take, for example, the State of Pennsylvania, in which there are over 5,000 offices. The prospective mail distributer buys a quantity of blank cards--about the size of the ordinary visiting card—and on each of these he writes the name of an office. On the back of the card he writes the name of the route by which the office is served with its mail. Taking in hand a package of these cards—say from 50 to 100—he goes over them one after another studiously, looking at the back each time and getting the name and route clearly associated in his mind. The second time he goes through the pack he finds that he knows the half of the route by reading the name of the office. It is a dull student who upon going over a pack of cards a dozen times does not know them thoroughly. The method is so simple and such an aid to memorizing that it is adopted by all railway mail clerks. By it clerks have been known to memorize a State like Pennsylvania inside of two months.

On all large routes clerks work but half time, the other half being devoted to rest and study. The mail clerk at home, continually reminded of coming examinations, carries his cards wherever he goes, conning them over at every opportunity. One demonstrative clerk on the New York and Pittsburg R. P. O. is famed for having learned the State of Ohio in four days. As he shuffled over his cards he walked from garret to cellar, and *vice versa*, from dawn until the shades of twilight fell. On the fourth day he went to the examiner's office and separated Ohio without an error.

It is related that the wife of a postal clerk adopted the card method for increasing her vocabulary in French. On one side of the cards she wrote the French word and on the other the English equivalent to be learned. Another lady, hearing of this, used the same system successfully for learning mythology, placing the word "Mars," for instance, on one side of the card and "war" on the other. The method has so many advantages over the old and tedious way of learning from the pages of a book that it might be utilized with advantage by teachers in search of new methods of imparting instruction.

AMERICAN HISTORICAL EXPOSITION, MADRID—PERUVIAN VASES.