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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 510,

For the Week Ending October 10, 1885.

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THE PENNSYLVANIA AEROLITE.

The people of Southwestern Pennsylvania were startled on the 26th of September, by the occurrence of a very unusual phenomenon; an immense aerolite had descended upon them. At first the impression prevailed that the district had been visited by an earthquake or that a terrible explosion of natural gas had taken place, while others decided that a pretty large set of boilers had burst, or that a gigantic blast had thrown down a large mass of rock from some neighboring quarry. Loud detonations were heard throughout that entire section, the explosions apparently following a straight line across the country, and causing not a little consternation among the people.

The meteor seems to have passed from the northeast to the southwest, and the noise of its passage, which was variously described as resembling the rattling of heavy artillery over a solid roadbed or as a mighty peal of thunder, was heard over a large area of country in the neighborhood of Pittsburg and to the south. A number of witnesses describe it as an immense mass of fire, fully as large as the largest barns—and Pennsylvania barns, it will be remembered, are noted for their size. A powerful flame of deep red color, which tapered off into a darker tail, seemed attached to the mass. This, however, is stated to have disappeared as the meteor came nearer, and the color of the mass changed to a bluish white, which was maintained as long as it remained in sight.

A mail carrier on horseback and a farmer who was plowing at the time both describe their animals as being so terrified that they remained perfectly motionless, and could not be persuaded to stir for several minutes after the fiery visitor had disappeared. It finally struck the earth on the farm of Mr. Buckland, in Jefferson Township, Washington County, near the West Virginia line. The stone broke into three pieces, and became partly buried. The color is gray, with streaks of red running over it; possibly from the formation of sesquioxide of iron. The form is irregular, and the dimensions, if correctly reported, are without precedent. It is stated to be from 30 to 50 feet in diameter, but we doubt very much that the statement can be verified. The Gibbs meteorite, in the Yale College Cabinet at New Haven, is noted for its size, but it weighs only 1,635 pounds, and has a length of 3 feet 4 inches, a breadth of 2 feet 4 inches, and a height of 1 foot 4 inches. It came from the Red River.

A still more noted one is the Tucson meteorite, from Sonora, Mexico, which is now at the Smithsonian Institution. It is ring-shaped, and 49 inches in its greatest diameter. The most remarkable masses of which we have any knowledge have been found in South America. One discovered in the district of Chaco-Gualamba was estimated to weigh 16 tons, and another found near Bahia, Brazil, to contain 28 cubic feet, and to weigh 7 tons. These weights and volumes would, however, be quite dwarfed by a comparison with those reported for the Pennsylvania meteorite. But there is probably still a little romance attached to these accounts, and the true dimensions will not be reached until later.

An odd superstition clings to meteors, and many who witnessed this remarkable one were inspired with the dread belief that it brought with it a spirit of pestilence and famine; but if these people would only call to remembrance the wide prevalence of meteoric visitors, they would conclude that the most persistent spirit which their imagination could attach to them must be quite exhausted by this time. Dr. Kleiber of St. Petersburg has calculated that 4,950 pounds of meteoric dust fall to the earth every hour, which would make 59 tons a day, or more than 21,500 tons in a year, while Professor Proctor thinks that even this estimate is too small. Yet very little damage is done by the fall of these "air stones," for the most of them fall upon unoccupied ground or into the sea. Relic hunters are reported to be already at work and carrying off the meteorite by piecemeal. This seems to indicate either that the mass was very much shattered by its fall, or that it has a large predominance of stony matter, which would enable fragments to be broken off; for the most accomplished vandal would find difficulty in securing a souvenir from a piece of meteoric iron.

GRAPHICAL COMPARISON OF PERFORATION FORMULÆ.

In connection with the Board on Armament of Fortifications, Major W. R. King, of the Corps of Engineers, U. S. Army, has compiled a comparative table of all formulæ relating to the perforation of armor plating; and in order to show at a glance the relative values obtained by using the different formulæ, has plotted the results to a uniform scale. As this sheet gives information of some interest to engineers, it has been published by the government and distributed to the different members of the corps. The two axes in the diagram represent the thickness of the unbacked wrought iron plating in inches, and the energy in foot tons per inch of shot's circumference, so that the resulting curves at any point show the values obtained from the formulæ of different authorities.

They display wide discrepancies, and, indeed, the variations in the quality of both the shot and the plate used by the investigators are such that it is quite impossible to obtain any general formulæ which are entirely accurate. The present graphical method has the advantage, however, of showing these conflicting results with admirable clearness, and it may be valuable in helping us to reach more uniform formulæ by calling attention to the existing confusion, and the need for further and more careful experimentation.

CURIOUS FEATURES OF THE ELECTRIC LIGHTING BUSINESS.

The business of the voltaic arc light companies may be said to furnish additional evidence of the credulity of human nature. The picture presented by hundreds of sub-companies spread over the country, living on prospects rather than profits, stimulates the observer and invites the analyst. At the recent meeting of the National Electric Light Association, it was not difficult to see in which direction the profit lay. Those engaged in selling light exhibited the unmistakable evidences of depression, while their fellows who confine their efforts to the sale of electric lighting plant were correspondingly elated and buoyant.

The first discussed economical processes with an interest that was profound and serious, as though their only hope of profit lay in a reduction of running expenses, while the second looked on with ill-concealed indifference.

To those who have had the time and inclination to study the electric lighting business, this will not be surprising. They will have discovered that there is an immense profit in electric lighting plant, and but little, if any at all, in the sale of the light. Like glucose, the electric lighting plant business is advertised but little; the private circular having been found to be the most judicious method of reaching purchasers.

Go into the office of one of the so-called parent companies, and talk about electric lighting plant, and you will be astonished by the prospective profits of light selling. It will be proved to you with mathematical precision that few modern enterprises offer such a large margin of profit as the operation of an electric lighting plant. But if there is so much profit in selling the light, why don't these companies go into the business themselves? Why do they confine themselves to selling plant? You will scarcely fail to be struck with this when hearing the plant people talk on the subject of light selling.

Last week two large electric lighting plant companies were consolidated. One of these companies only two years ago had a little office in Union Square, before which a single arc light hung suspended. This was rarely lighted, as if the dispensing of arc light was a luxury far too costly to be indulged in by any but sub-companies.

This company has now a great factory in New York city, where large quantities of lighting plant are manufactured for those provincial projectors who are possessed of robust bank accounts and adamantine credulity.

Fortunes have been made in arc light apparatus, but the only people who have profited, thus far, from the light itself are the gas companies, because its brilliancy so pales the gas jets by comparison that gas consumers, in order to counteract its influences, are forced to turn on more burners and use more gas.

STUDENT MECHANICS.

The most ardent supporters of technical schools do not claim that they can supersede the workshop; but they do claim, properly, that the inexperienced boy can obtain in them a general knowledge of the character of materials, the methods of working them and the reasons why these methods differ. None of our older mechanics ever regret the smattering of theoretical knowledge of natural laws that they obtained at school from the meager instruction afforded by the text book on natural philosophy; and in after years some of its statements—mere commonly known axioms—have been easy to quote, and beneficial to heed. Book knowledge on practical subjects may be useful, even if it does not teach the handling of tools and the best methods of doing a job. As a preliminary to the shop novitiate, the technical school is a wonderful helper.

Sometimes boys of fourteen or fifteen see clearer than do their elders the possible advantages of a theoretical mechanical education; but no experienced mechanic can visit one of our modern technical schools without feeling that he was a loser because they were not in his boyhood days, and that he had no opportunity for the advantages which they unquestionably give to the embryo mechanic. Such a school is a means of guiding the young man to the choice of an occupation; mechanical bent, discouraged at home, is given room for development. Occasionally, however, a parent has the wisdom to help the son in his inclination.

An instance in illustration is that of a boy of fourteen, left by his father, a prominent government official, with a considerable fortune. He shows a decided taste for mechanics, is provided by his sensible mother with a home workshop used in vacations will leave

his grammar school for a technical school at the expiration of his course, and will be graduated from thence —if events are fortunate—to a workshop; so, instead of going into a "genteel" profession, he will become a useful mechanic.

A college professor in an Eastern State "releases his mind" by employing himself in a workshop in his attic. He has placed many articles of elegant and useful furniture in his house, which are the work of his own hands, and are admired by all who visit at his house. By the connivance of his wife, broken chairs, leaky tinware, dilapidated toys, and similar articles are gathered from the neighborhood to delight the sedate and learned professor, who revamps them as an amusement. He said in conversation, a short time ago, that if the technical school had existed in his callow days, he would have been at the head of a mechanical shop instead of a professor in a college, and he thought he might have been a more contented man.

A NEW STAR WITHIN A STAR CLOUD.

BY RICHARD A. PROCTOR.

A star has given an answer to the theory, complacently repeated long after it has been disproved, that the nebulæ or star clouds are external galaxies. The entire aspect of the star-strewn heavens may in a sense be said to be altered by the appearance of a star—though it be but of the eighth magnitude—in the heart of the great nebula in Andromeda. At once we see that all the varied glories of the star depths, giant suns and suns like our own, isolated suns, and groupings of minor suns, all forms and orders of star clouds, are as certainly part of the glory of our own galaxy as all the varied orders of planets are of the realm over which our sun bears sway. Stars have appeared ere now in the midst of nebulous masses; but these masses have in every case of the kind, thus far, been gaseous. The Andromeda nebula, whatever be its actual constitution, is not a great mass of luminous gas. It is not one of those nebulæ that like the great "fish mouth nebula in Orion," the still vaster "keyhole nebula in Argo," or the "lover's knot nebula in Dorado," have given evidence, under spectroscopic scrutiny, of being great self-luminous masses of hydrogen, nitrogen, and some other as yet undetermined gas. Instead of the three or four bright lines into which the light of the gaseous nebulæ is resolved by the spectroscope, the light of the nebulæ in Andromeda gives a spectrum like that of a star or of our own sun—a rainbow-colored streak crossed by dark lines, and only differing from the spectrum of a star in showing rather stronger absorption near the red end than is usual in stellar spectra.

In the midst of this great mass of stellar material, how distributed we know not, a new star has suddenly made its appearance. I was about to say that this new star came into existence but a few days ago. But who shall say how old the news really is that the light rays from the Andromeda nebula have recently brought us? From even the nearest star, light takes 3½ years to reach us, from Sirius 20 years at least, and from the great majority of the stars that deck our skies, hundreds of years. It may well be that the outburst, or whatever other change it was, which has made the new star visible to us occurred a thousand years ago; for assuredly the greater number of the stars which shine no more brightly than this new one does (stars which the keenest human vision cannot see) lie at distances which light could not traverse in less than a thousand years. It is as thus viewed perhaps that the study of the great nebula in Andromeda acquires chief interest; the nebula lies at so immense a distance that it must be inconceivably large. Putting it no farther away than the nearest star—and probably it is many times farther away—its volume must exceed many thousands of times the whole domain of the sun. If the orbit of the distant Neptune encircled like a belt a gigantic sphere, whose whole surface shone with the same intrinsic luster as our sun's, that monstrous orb, removed to the distance of the Andromeda nebula, would look no larger (though of course it would look far brighter) than the nuclear heart of that star cloud. The nebula must have a volume measurable only by billions of trillions of cubic miles of space. Be it remembered that this estimate of the extent of the region occupied by this wonderful nebula is far short of that which had to be adopted by those who accepted the usual account of the nebula. For, according to that account, the nebula in Andromeda does not lie within the galaxy at all, but thousands of times farther away than the remotest parts of our stellar system. It is in fact, or rather was, according to that account, a galaxy itself, reduced by vastness of distance to the appearance of a mere faint fleck of misty light on the dark vault of heaven—a fleck barely to be seen by the unaided eye.

Hereafter, of course, the great Andromeda nebula can no longer be so regarded. The change involved by the appearance of the new star in the midst of a nebula which under the most powerful telescopic scrutiny had shown no trace of a star, would be too stupendous to be regarded as possible, or even conceivable. We can imagine that when a new star shone suddenly forth in the Northern Crown in 1866, astronomers in some remote part of our own galaxy might have recognized the new star, as we did, who are near the middle of the galaxy; we may even conceive that astronomers living in some outlying galaxy, if armed with telescopes to show individually all the thousands of millions of stars in our stellar system, might have noted that new star as one added to those countless millions. That would be supposing such astronomers much keener sighted, and much readier at counting multitudinous points, than any astronomers who have yet appeared on this earth. But that would not in the slightest degree resemble what our astronomers have recognized in the Andromeda nebula. There they have seen a star, visible with very small telescopes (Argelander's 2½ inch telescope showed stars down to the tenth magnitude), making sudden appearance in the heart of a star cloud which had been scrutinized with the most powerful telescopes yet made by man, without any trace of a star being discovered in it. It is as though in the heart of our galaxy there should suddenly appear a star outshining all the other stars hundreds of thousands of times.

We are compelled, then, to assume that no such change as this has taken place. What has happened has manifestly been simply that, in a star cloud forming part of our own galaxy, a change has taken place by which a star, probably no larger than those minor suns which form the wealth of the Milky Way, has made its appearance. Possibly the star will be found to last but for a short time, like the one which shone out in the Northern Crown as a second magnitude star, and that other which but a few years ago blazed suddenly forth in the Swan—to fade out again, not like the former into a faint star such as it had before been, but into a bluish globe of gaseous matter, in fact, into what is called a planetary nebula.

One conclusion which has been drawn from the appearance of the new star in the midst of the Andromeda nebula, I venture to regard as entirely erroneous. It has been said that the phenomenon confirms, if it does not establish, Laplace's theory of the origin of our solar system from a great mass of rotating gas. If any occurrence in the star depths could possibly shake men's faith in that theory—or rather speculation, for so Laplace regarded it—the sudden appearance of a new star in the midst of a mass of stellar matter should do so. A theory which has been accepted by astronomers under the mistaken idea that there are no physical objections against it, and by physicists under the equally mistaken idea that observed astronomical facts absolutely require it; a hypothesis according to which a mass of gas, far rarer than hydrogen at atmospheric pressure (nay, almost infinitely rarer), and having a span of about six thousand millions of miles, rotated for millions of years as a coherent whole—such a theory may be expected to retain vitality under almost any conceivable shock. Otherwise, assuredly the discovery that sudden and rapid changes, not the inconceivably slow changes imagined by Laplace, affect star clouds, of enormous size, might be expected to destroy men's faith in an idea which its celebrated author never regarded as more than a guess, and which with the knowledge of physical laws possessed in our time should have been long since rejected as obviously erroneous. Whatever light the further telescopic study and the spectroscopic study (yet to be begun) of the new star and of the changing nebula may bring, I venture to express confident assurance that the nebular hypothesis of Laplace will not be confirmed. If the change in the Andromeda nebula throws any light at all on processes of evolution, it will rather be on those by which the galaxy reached its present condition than on those belonging to the past of our solar system. We are beginning to recognize in the architecture of the galaxy evidence of processes by which regions of space incomparably vaster than the whole domain of the sun are affected, or have been affected in the past, under the action of forces which seem to have a different character from any whose operation we can follow within the solar system. We see that isolated suns have been drawn to one region, streams and aggregations of minor stars in other directions. and the nebulæ elsewhere again; precisely as, within the solar system, we have the giant planets, the terrestrial planets, the asteroids, the systems of satellites, and so forth, each occupying their appropriate domain. It may well be that in the study of local changes still going on, some light may be thrown on long past processes by which the stellar groupings attained their present form.

Suit about a Chimney.

A dispute has arisen between the Bridgeport, Conn., Water Company and the Bridgeport Paper Company regarding the ownership of a chimney which both have jointly used for many years. The paper company wish to pull down the chimney and build a larger one, and on Sunday they began to pull it down, but were restrained by an injunction signed by Judge Granger, of the Superior Court. The water company claim that they cannot do without a chimney, even for a single day, as more than 40,000 people depend upon the company for a supply of water.

Foreign Roads.

France has some 19,000 miles of railroads. The scientific spirit of this nation, says a London paper, is shown by the fact that their trains pass to the left of each other, and not to the right. We go to the right in our wagons and trains, probably from having confounded the moral meaning of the right with the physical right hand. We say, do right, and therefore we go right, whereas we would do right if we went left. You drive your horse sitting on the right of him, and therefore the man who has to pass you on the right is partly hidden from you by your horse's head. If you sat on the left you would see the man on your right, and if he sat on the side nearest to instead of furthest from you, he would not have half the trouble he now has. The French, therefore, is the left-eyed nation. Passengers get out of the trains on the left hand side. The government taxes every ticket sold by a railroad since the late war. The trains are classified, and only high class passengers—those who pay the highest fares —go on the fastest trains. We have copied from the French our late system of shutting the passengers up in the station until the train is ready, and they can go through the gate and show their tickets. French travelers are allowed only two-thirds of 100 pounds of baggage free; those who are going outside of France are allowed only 55 pounds. The railroad charges for entering the baggage or booking it. We have already adopted the French plan of collections on packages left at the station, but the French only charge one penny, while we charge two. All the railroads in France are run on Paris time.

About Fig Trees.

"Will fig trees that are planted out in the garden bear better than those that are grown in boxes, and wintered in the cellar? How deep should they be planted? And in burying for winter, should they be first covered with straw, or with earth only?"

Wm. Falconer answers the above query in respect to the culture of this delicious fruit in the *American Garden* as follows:

Fig trees planted out bear better than those in boxes, and with far less trouble. You are more certain of a crop from young plants that are grown in tubs or boxes that you would be from the same sized or aged plants that are planted out, but the out-door plants can become large bushes, hence have more fig-bearing wood than box-grown ones. All the care the out-door fig trees need is to bend them down and peg them flat to the ground, and bury them about a foot deep with earth in the fall, and unearth them again in spring. My neighbor, Mr. Barlow, on Long Island, gets enormous crops off his fig trees treated in this way.

When planting fig trees, plant as you would any other bush or shrub; shake the earth from the roots and spread them out. There is nothing delicate about the rooting of a fig tree. It roots easily.

In burying for winter, use earth only. Straw or litter would be cozy winter quarters for field mice, and peeling the fig trees capital amusement for the mischievous rodents.

Duty of Coal.

Notwithstanding the well-known imperfections in all appliances for utilizing the full amount of energy which is due to the combustion of coal, both on land and water, the great improvements in that direction which have been made during the last quarter of a century are indeed remarkable. A single example, for instance, is afforded in the case of the steamer Burgos, built especially to carry cargoes cheaply at a low speed, and which left England for China with a cargo weighing 5,600,000 pounds. During the first part of the voyage, from Plymouth to Alexandria, the consumption of coal was 282,240 pounds, the distance being 3,380 miles; the consumption per mile was, therefore, only 83·5 pounds, and the consumption per ton of cargo per mile, 0·028 pound; in other words, half an ounce of coal propelled one ton of cargo per mile. It is further stated that the best locomotive performance in this country shows a consumption of about two ounces of coal per ton of freight hauled one mile, at the rate of 13 miles an hour, including stoppages; on lines having grades of from 53 to 70 feet per mile, the consumption often rises to five or more ounces.—*N. Y. Sun.*

Manufacture of Aluminum by Electrolysis.

La Lumiere Electrique says that Mr. L. Senet has devised a new process that permits of obtaining aluminum, as well as copper, silver, etc., by electrolytic way. A current of from 6 to 7 volts and 4 amperes is made to act upon a saturated solution of sulphate of aluminum in the presence of a solution of chloride of sodium, the two solutions being separated by a porous vessel. There forms a double chloride of aluminum and sodium, which is decomposed; and the aluminum that is set free deposits upon the negative electrode.

The process may be applied either for obtaining deposits of aluminum upon any objects whatever, or, what is more important, for the cheap manufacture of the metal.