shelter and ornament, he knows of nothing that he would sooner select than the Osage orange. The young plants may be procured abundantly and cheaply; they start as surely as any of the soft-wooded trees; they grow rapidly, stand heat and drought admirably, and are impatient only of wet feet, so they do not take kindly to low and wet situations. Not only is the timber very hard and very durable, but it has great beauty of grain, and when sawed into veneers or plank and used in solid form, it may be made, like black walnut or mahogany, into office or household furniture of the most attractive style. Its durability is quite wonderful and deserves to be enlarged upon. Where a hedge has been winter-killed, as is sometimes the case in the North, when an intensely cold winter follows a hot and growing season, the dead fence will sometimes stand for years and perform the office of a live one. Young trees of not more than two or three inches in diameter, or the limbs of maturer ones of the same size, are not only stronger and stiffer than any other wood that can be procured, but as vine stakes they outlast any wood that has yet been tried. When dry the wood is as hard as hickory and as heavy as oak, and this may prove an objection to its being sawed into boards or planks for building or fencing."

To this tribute to the valuable qualities of the Osage orange we may add a few further details given by other authorities. One writer, for instance, states that those who live where the tree abounds say that while the exposed wood may waste away gradually, through the action of the elements, yet a rotten or decayed stick is never seen. The wood, which is of a fine yellow color, close-grained, hard, strong, and elastic, changes but little with alternate wetting and drying, and in addition to its other industrial uses is said to be especially valuable for wheels. The bark of the tree affords a fiber similar to that of the paper mulberry, and the wood abounds in a yellow coloring matter, which is especially abundant in the roots, and of an intense orange shade. The well known yellow dyewood, fustic, is the product of an allied species, *Maclura tinctoria*, growing in Central and South America.

The Milk of the Cow Tree.

No tree aroused the imagination of Humboldt so keenly as the *Broximum galactodendron*, or *Palo de leche*, or cow tree, which grows upon the slopes of the Cordilleras of Venezuela. As the nutritious juice of this tree is allied very closely to the rubber tree of Brazil—and, indeed, may yet come to supply a rubber to the European markets—the following account of its composition, communicated to the French Academy of Sciences by M. Boussingault, may not be without interest. The cow tree grows to a height of from 15 to 20 meters; its leaves are oblong, alternate, and terminated by points. The creamy juice is obtained by cutting into the inner bark. It is used by the natives in place of cow's milk. The analysis of 100 parts of the milk, containing 42 parts of fixed matter, is as follows:

Wax and saponaceous matter, 35·2; sugary substances, 2·8; caseine, albumen, 1·7; earths, alkalies, phosphates, 0·5; indeterminate substances, 1·8; water, 58·0—100·0.

The cream of the cow, according to an analysis of M. Jeannier, contains:

Butter, 34·3; milk sugar, 4·0; caseine and phosphate, 3·5; water, 58·2—100·0.

It will be observed that wax appears in the vegetable milk in about the same proportion as butter in the animal.

Insulation by Gutta Percha.

A suit was brought, in 1872, by Clinton G. Colgate, assignee of Arthur N. Eastman, against the Western Union Telegraph Company for an injunction and an accounting of profits, for the use of an invention patented by George B. Simpson. The patent claimed the insulation of telegraph wire with gutta percha, thus creating a submarine conductor of electricity. The inventor claimed to be the originator of submarine cables, and declared that it was to his invention that the success of the Atlantic cables was due. The attorneys of the Western Union Telegraph Company testified upon the trial that the company had in use about 60,000 miles of telegraph wire in which gutta percha is used as an insulator.

After six years of litigation a decision was reached in this case November 25, Judge Blatchford, of the U. S. Circuit Court, deciding that on all the points at issue the plaintiff had established his case. It is said that the case will be appealed to the U. S. Supreme Court, by the Western Union Telegraph Company.

The history of Mr. Simpson's long protracted fight with the Patent Office before his right was acknowledged is not less interesting for the exhibition it affords of pluck and persistence on the part of the inventor than for the illustration it furnishes of the injustice that may come through a misconception of the duties of the Patent Commissioner. In view of the vital importance of Simpson's invention to the success of telegraphy the world over, the following story of his efforts, as brought out during the trial, will prove of interest to our readers.

Gutta percha was imported into England from the East Indies about 1845, and was there used as a mastic cement and as a plastic material for covering reins, straps, and bands, and for moulding various articles. Its insulating properties were, however, not discovered at that time. In 1845 Professor Morse attempted to insulate a telegraph wire with beeswax, asphaltum, and cotton yarn. This mode of insulation failed. In 1846 Ezra Cornell and Professor Morse tried to carry a wire across the Hudson River at Fort Lee insulated with asphalt and hemp, and also one inclosed in glass beads and in a lead pipe. This also failed. Downing's line from Philadelphia to New York tried India rubber as an insulator for aerial wires in the spring of 1848, but this also failed. The first Magnetic Telegraph Company, or Southern Telegraph Line, tried wires covered with asphaltum and in lead pipes in the fall of 1847, at various points on their line, particularly at Passaic River.

It is claimed that the first publication in England of the insulating properties of gutta percha was made by Professor Faraday, in March, 1848. Prior to this time, however, George B. Simpson, the inventor in this case, had filed an application for a patent in the United States Patent Office, claiming the insulation of telegraph wire with gutta percha. This application was dated November 22, 1847, and was sworn to and filed in January, 1848, more than a month before Faraday's announcement. The inventor at that time was too poor to pay the fee of the Patent Office, and continued to be in the greatest poverty all his life. He filed a second or amended application for the patent in February, 1848, and a third in April, 1849, when he succeeded in paying the Patent Office fee of $30 by the assistance of the late Horace H. Day. He exhibited his invention in Baltimore in the spring and fall of 1848, and it was there tested and found successful. He also, as early as December, 1847, exhibited his invention to the late Hon. Amos Kendall and F. O. J. Smith, in Cincinnati. In 1850 his application was erroneously rejected by the Patent Office, and he was referred to the officers of the Magnetic Telegraph Company, including Mr. Kendall, as alleged prior inventors, all of whom, it appeared subsequently, derived the knowledge they received on the subject from him. The Patent Office repulsed his repeated applications. He was compelled to withdraw his fee by his agreement with Day. He worked his way out to the Pacific between 1852 and 1857, in the hope of obtaining money to renew and prosecute his application. Returning in 1858, he found his invention largely in use. He had accumulated a little money, and promptly renewed his application for the patent. He was again rejected by the Patent Office, which now confessed that the previous action in rejecting him had been erroneous, but that it was now too late to obtain a patent.

He persevered from 1858 to 1866, filing repeated applications with all the Commissioners of Patents who were in office during that time, and in 1862 presented an application to Congress for relief, and received a most favorable report on the originality and novelty of his invention. Finally, in 1867, after twenty years' litigation in the Patent Office, his efforts were crowned with success, and a patent was issued to him as the originator of the first practical method of constructing an ocean telegraph. Simpson, however, died a few months after the grant of the patent. He was then employed as paymaster in the United States army—a position procured through the influence of persons who were interested in his endeavors to secure his rights. He died of yellow fever, in New Orleans, in October, 1867.

Duplexing the Atlantic Cable.

The simultaneous transmission of two telegraphic messages in opposite directions upon one wire, now known by the name of duplex telegraphy, dates back from the year 1853. In that year Dr. Gintl, the director of state telegraphs in Austria, described a method by which this feat could be accomplished, and in July of the same year the method suggested by Gintl was tried between Prague and Vienna. An improvement on this method was suggested by a German electrician, Frischen, by Messrs. Siemens and Halske, of Berlin, and other workers at this subject. Nevertheless, owing to practical difficulties, the experiments were little more than interesting additions to our knowledge. So little hope, indeed, was there of the practical realization of this important matter that, in a standard work on telegraphy, published in 1867, after describing the early methods of duplex telegraphy, the author remarks: "Systems of telegraphing in opposite directions, and of telegraphing in the same direction more than one message at a time, must be looked upon as little more than feats in 'intellectual gymnastics,' very beautiful in their way, but quite useless in a practical point of view." Such assertions should teach all scientific writers the lesson of "hoping all things not impossible, believing all things not improbable," an attitude of mind which, Sir John Herschel remarks, should always characterize the natural philosopher, and which, in the present day, is certainly the safest one. Within six years of the publication of the foregoing statement duplex telegraphy was not only largely employed in actual telegraphy, but its use on certain busy lines became absolutely indispensable. The change from theoretical to practical success is due to an American, Mr. J. B. Stearns, who, in 1872, succeeded in overcoming the main obstacle in duplex telegraphy, namely, what is known as the static discharge from the line. This Stearns accomplished by using a "condenser;" and further, he developed a system of "duplexing" the line similar to the principle of the Wheatstone bridge.

More or less successful attempts were afterwards made to duplex submarine cables, and in the early part of 1877 Mr. J. Muirhead succeeded in duplexing the cables of the Eastern Telegraph Company by his artificial condensers. But we believe that his success was only partial. Subsequently Mr. Muirhead has been at work duplexing the Direct United States Cable, with some prospect of success, and lately Stearns, who may be called the father of duplex telegraphy, has actually achieved the great feat of perfectly duplexing the Anglo-American cable. In a message received by Mr. W. H. Preece, Mr. Stearns says, "I managed to get some specimens for you this morning, though we had no time to make the balance especially perfect for the purpose."

All the messages now sent across the Atlantic are automatically registered by means of Sir W. Thomson's delicate and beautiful siphon recorder, which spirts out little jets of ink in a fine stream on a moving ribbon of paper. When no current passes the ink marks form a straight line, but a current causes this line to deviate to the right or left, according to the direction of current. Hence the ordinary right and left strokes of a needle instrument, or the long and short dashes of a Morse, are indicated by marks above and below the middle line.

The essence of duplex telegraphy is to obtain an electrical balance round on the line, such that the sending instrument is not affected by currents circulating round it coming from the sending end, but only by currents received from the opposite end, and *vice versa*. Hence, if the balance be once obtained, double transmission is possible. This balance Stearns has succeeded in obtaining by the use of his system as applied to land lines, and without the aid of the additional arrangements of artificial condensers used by Dr. Muirhead. —*Nature*.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, December 21, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated:

PLANETS.

	H.M.		H.M.
Mars rises	4 54 mo.	Uranus rises	9 44 eve.
Jupiter sets	7 35 eve.	Neptune in meridian	8 20 eve.
Saturn in meridian	5 50 eve.		

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	6 01 eve.	Procyon rises	7 12 eve.
Mira (var.) in meridian	8 11 eve.	Regulus rises	9 16 eve.
Algol (var.) in meridian	8 58 eve.	Spica rises	1 57 mo.
7 stars (Pleiades) in merid.	9 38 eve.	Arcturus rises	0 59 mo.
Aldebaran in meridian	10 27 eve.	Antares rises	6 03 mo.
Capella in meridian	11 05 eve.	Vega sets	9 25 eve.
Rigel in meridian	11 06 eve.	Altair sets	8 13 eve.
Betelgeuse in meridian	11 46 eve.	Deneb sets	0 34 mo.
Sirius rises	7 37 eve.	Fomalhaut sets	8 48 eve.

MOON'S PLACE IN THE CONSTELLATIONS AT 7 P.M.

Saturday, *Scorpio*	5°	Wednesday, *Capricornus*	1°
Sunday, *Scorpio*	19°	Thursday, *Capricornus*	14°
Monday, *Sagittarius*	4°	Friday, *Capricornus*	26°
Tuesday, *Sagittarius*	17°		

REMARKS.

Mars will be 5° north of the moon December 21. Before the discovery of the moons of Mars there was no accurate method of calculating the mass of the planet. Laplace, in his "Celestial Mechanics," gives the mass as $\frac{1}{1846082}$ of the sun. Prof. Asaph Hall, the distinguished discoverer of the small Martial satellites, has calculated the mass from the motion of the satellites, and announces the result in "Observations and Orbits of the Satellites of Mars, with data for 1879." The mass of the sun being unity, he finds that of Mars to be $\frac{1}{3093500}$, with a very small possible error, which, he thinks, will be eliminated in 1879. Jupiter will be about 1° south of the moon December 26.

American Exports and Imports.

The gold values of the exports of merchandise from the United States, and imports of merchandise into the United States, during the last fiscal year, as appears from returns made to and compiled by the Bureau of Statistics, are as follows:

Exports of domestic merchandise	$680,709,268
Exports of foreign merchandise	14,156,498
Total exports of merchandise	694,865,766
Imports of merchandise	437,051,532
Excess of exports over imports of mer'dise	$257,814,234

Compared with the previous year, the importations are less by $14,271,594, and the exportations are greater by $92,390,546.

The annual average of the excess of imports over exports of merchandise, for the ten years ended June 30, 1873, was $104,706,922; but during the last three years there has been an excess of exports over imports as follows: In 1876, $79,643,481; in 1877, $151,152,094; in 1878, $257,814,234.

Results of the Paris Exhibition.

The total admissions to the late Paris Exhibition were 16,032,725, against a total for the Centennial of 9,910,966. The Exhibition at Paris, however, was open more than a month longer than the one at Philadelphia, while the actual receipts at the latter place were about 50 per cent larger than at the former. This year at Paris, as compared with 1867, shows nearly double the number of admissions, and an increase of 75 per cent in receipts. In spite of this increase the Exhibition held during the Empire involved an expenditure of considerably less money. In 1878, 45,000,000 francs were appropriated, and a deficit is reported of 15,000,000 francs more.