POSITION OF THE PLANETS IN DECEMBER.

JUPITER

is evening star. He takes the highest rank on the December annals for the third month in succession, as no other planet in its present aspect can be compared with him in size or brilliancy. Although he has been receding from the earth since October 12, he has lost but little of the superb luster that marks his presence in the heavens, and, although his diameter on the 31st is 39".6, against 47".6 when in opposition, his apparent size has but slightly diminished. Jupiter is stationary on the 10th, and then turns his steps eastward or in direct motion. There is scarcely an incident to diversify his path. If, however, there are no important epochs in his December course, the discovery of the fifth satellite has increased the prestige that surrounds the giant of the system, and will inspire observers to find other satellites or something else equally wonderful. It surely is a marvel when one thinks of a tiny moon only one hundred miles in diameter, revolving around its huge primary in twelve hours, at a distance of 26,000 miles from the planet's surface! Most of its time must be spent in making a transit on the disk or in being occulted in the planet's vast shadow that extends 50,000,000 miles out into space. These are facts that make one think, and impress the soul with the vastness of the scale on which our little oasis of a system has been evolved.

The moon, the day after the first quarter, is in conjunction with Jupiter on the 27th, at 9 h. 6 m. A. M., being 32′ south. The conjunction is invisible, as it takes place below the horizon. It is an occultation for observers who see the moon in her geocentric position and are between the limiting parallels of 16° north and 75° south.

The right ascension of Jupiter on the 1st is 0 h. 58 m., his declination is 4° 37′ north, his diameter is 43".7 and he is in the constellation Pisces.

Jupiter sets on the 1st at 2 h. 28 m. A. M. On the 31st he sets at 0 h. 34 m. A. M.

MARS

is evening star. He is in quadrature with the sun on the 9th, at 6 h. 22 m. P. M., being 90° east of the sun. He is then on the meridian at sunset and sets at midnight. Quadrature is the second epoch in the course of Mars if we commence with his opposition, which took place on August 4. The third epoch will be his conjunction with the sun, on September 4, 1893, when he becomes morning star, and is for months so small and near the sun as to be invisible. He will then swing round to his quadrature on the sun's western side, his fourth epoch, and, after that, in due time he will arrive at the opposition of 1894 and commence a new circuit. It takes Mars two years and about fifty days to accomplish this journey from opposition to opposition again. It is called his synodic period, for it is only at opposition that the sun, the earth and Mars are in line, with the earth in the middle. The synodic period may also commence with conjunction and is completed when conjunction is again reached, for Mars, the sun and the earth are then in line, with the sun in the middle.

Mars moves eastward or in direct motion, and is also traveling northward. When the month closes, his declination is 1° 2′ north—a fact that would have greatly pleased northern observers if it had occurred at the time of his opposition, for then he would have been above the fogs and bad atmosphere of the southeastern horizon. Jupiter is 5° 2′ north declination on the 31st and sets about an hour later than Mars.

The moon, on the day of the first quarter, is in conjunction with Mars on the 26th, at 2 h. 25 m. A. M., being 3° 7′ south.

The right ascension of Mars on the 1st is 23 h. 0 m., his declination is 7° 27′ south; his diameter is 10".4, and he is in the constellation Aquarius.

Mars sets on the 1st at 11 h. 45 m. P. M. On the 31st Mars sets at 11 h. 25 m. P. M.

VENUS

is morning star. She is slowly making her way toward the sun, rising when the month closes only two hours before him. Her light number on the 31st is 63.4, in comparison with 187.9 when at her greatest brilliancy. The illuminated portion of her disk is represented by 0.868 on the 31st, in comparison with unity or 1 at superior conjunction when her whole illuminated disk is turned to the earth. Her diameter on the 31st is 12".2, in comparison with 57".4 at inferior conjunction. These figures show that Venus is far from being in her best estate, but she is none the less a beautiful morning star, as, linked more closely to the sun, she heralds his near approach. Venus is in conjunction with Uranus on the 4th at 7 h. 49 m. P. M., being 1° 37′ north.

The moon, three days before her change, is in conjunction with Venus, on the 16th, at 5 h. 5 m. A. M., being 3° 18′ south. The conjunction is visible, but the actors in the celestial scene are very near the eastern horizon and low in the south.

The right ascension of Venus on the first is 14 h. 9 m., her declination is 10° 58′ south, her diameter is 14".0, and she is in the constellation Virgo.

Venus rises on the 1st at 4 h. 1 m. A. M. On the 30th she rises at 5 h. 9 m. A. M.

SATURN

is morning star. He is a brilliant object in the morning sky, rising soon after midnight, and seemingly making his way toward Spica, the bright star on the southeast.

The moon, two days after her last quarter, is in conjunction with Saturn on the 12th at 4 h. 48 m. P. M., being 4′ south. The conjunction is invisible, but moon and planet will not be far apart when they appear soon after midnight on the scene. The moon will occult Saturn for those observers who see her under the right conditions.

The right ascension of Saturn on the 1st is 12 h. 42 m., his declination is 2° 5′ south, his diameter is 15".6, and he is in the constellation Virgo.

Saturn rises on the 1st at 2 h. 2 m. A. M. On the 31st he rises at 0 h. 13 m. A. M.

MERCURY

is evening star until the 11th, and then morning star. He reaches his inferior conjunction with the sun on the 11th at 11 h. 48 m. P. M., and then makes his appearance on the sun's western side to pursue his swift course as morning star. He moves with great rapidity in this portion of his career, and is at his greatest brilliancy on the 26th, when he is visible to the naked eye in the southeast as morning star.

The right ascension of Mercury on the 1st is 17 h. 54 m., his declination is 24° 49′ south, his diameter is 8".2, and he is in the constellation Scorpio.

Mercury sets on the 1st at 5 h. 32 m. P. M. On the 31st he rises at 5 h. 39 m. A. M.

NEPTUNE

is morning star for nine hours, and then evening star, for he is in opposition with the sun on the 1st at 8 h. 52 m. A. M. This event changes his position from the sun's western to his eastern side, and ranks him with the evening stars. Neptune at opposition is most favorably situated for terrestrial observation, and if any new discovery is ever made concerning this far-away planet, it will probably be made in this part of his course. He is invisible to the naked eye, though some observers claim to have detected his presence with the aid of an opera glass. A small telescope will bring him into the field as a tiny disk of a delicate blue tint, and a powerful telescope will bring him to view with a small moon for an attendant. Discovered in 1846, it will take him until 2011 to complete a revolution.

The right ascension of Neptune on the 1st is 4 h. 34 m., his declination is 20° 22′ north, his diameter is 2".7, and he is in the constellation Taurus.

Neptune sets on the 1st at 6 h. 59 m. A. M. On the 31st he sets at 5 h. 1 m. A. M.

URANUS

is morning star. The moon is in conjunction with Uranus, four days before her change, on the 15th, at 1 h. 26 m. A. M., being 41′ south. She also occults the planet for the benefit of observers who see her under the right conditions. Three planets, Saturn, Uranus, and Jupiter, are occulted during the month.

The right ascension of Uranus on the 1st is 14 h. 25 m., his declination is 13° 54′ south, his diameter is 3".5, and he is in the constellation Libra.

Uranus rises on the 1st at 4 h. 23 m. A. M. On the 31st he rises at 2 h. 32 m. A. M.

Jupiter, Mars, and Neptune are evening stars at the close of the month. Mercury, Venus, Saturn, and Uranus are morning stars.

Maple Hill Coal Mines.

The anthracite coal region of Schuylkill County covers about 230 square miles, and when the comparatively shallow districts are exhausted there are immense veins to be won by deep mining. Through the gap in the mountains, the Pennsylvania Railroad and the Philadelphia and Reading Railroad wind side by side. The latter climbs 603 feet in three and a half miles, attaining a summit elevation of 1,479 feet above sea level, and then winds down to the valley, 350 feet below; the bottom of the valley being surrounded by black, barren culm banks, and leveled off by a swamp of washed dirt and dust, with pools and streams of black water. At Maple Hill Colliery is a great coal breaker with a capacity of 2,000 tons per day. The shaft is 753 feet deep to the bottom of the sump, and is timbered from top to bottom. It is 23 feet by 11 feet 8 inches, subdivided into three compartments, two for hoisting and one for pumping, all 11 feet 8 inches by 7 feet clear. From the bottom of the shaft, tunnels, aggregating 800 yards in length, have been driven north and south, opening on two dips, with 400 yards breast on each, the following beds: Holmes, 10 feet 6 inches thick; Mammoth Top Split, 14 feet; Mammoth Middle Split, 14 feet 6 inches to 20 feet; Mammoth Bottom Split, 12 feet to 15 feet; Skidmore, 7 feet 6 inches; Seven Foot, 5 feet to 7 feet; Buck Mountain, 12 feet to 15 feet; total, 75 feet 6 inches to 89 feet.

The tracks at the foot of the shaft are arranged so as to work automatically, the loaded cars being delivered on one side while the empty cars run off by gravity, and are raised by a chain hoist to a common distributing point. The hoisting power is furnished by a pair of first motion engines, with cylinders 30 inches by 60 inches, connected to a 12 foot cylindrical drum, and are capable of hoisting eight mine cars in five minutes, or a total of 1,000 cars per day. Each mine car contains 116 cubic feet, and yields 2¼ tons of marketable coal. The shaft was begun in December, 1888, and finished in September, 1890, being sunk by power drills driven by compressed air.

The Engineer.

The experience of no one man, no matter how extensive his practice or how varied his opportunities, will cover much of the aggregate field of engineering. Think for a moment how little of your own knowledge of engineering is based upon your own unaided efforts and experience. How many of the rules which you use did you work out for yourself from data derived only from your own practice? When you have a piece of work to do that is entirely different from anything you have attempted before, what do you do? You hunt for an instance where somebody has successfully done such work before; or, if no such case exists, you lay out the work as best you can in the light of what has been done, taking the result of other men's tests as to strength of materials, proportions of parts, etc., and the failure or success of your work becomes a precedent to be avoided or followed by the next man who has a similar task to perform. It is the aggregate experience of the profession that constitutes engineering knowledge, and the more a man reads, the more of other men's thoughts and experience he absorbs, the more valuable he will become. Think of this the next time you hear a slur thrown at the "book engineer." It is not the function of books or papers to make engineers, but to record and disseminate the progress and experiences of the profession, thus adding to the aggregate knowledge of all. You can make up your mind, when you hear a man boast that he can get along and run his plant without reading, that he has not got along far enough to know how little he knows, or to be intrusted with the execution of work that requires any knowledge to speak of.—*Power*.

Turmeric.

This is a root of a plant growing in India, China, and Madagascar, and now chiefly cultivated in Bengal. The roots are long, and vary in thickness from that of a quill to about an inch in diameter. They are wrinkled and have joints or ring-like swellings at short intervals. Outwardly the color is a yellowish-gray, while inwardly it is of a deep yellowish-brown, darkest in the middle. When reduced to powder they appear of a bright yellow. The roots contain from 5½ to 6 per cent of mineral matter, moisture from 5 to 7, and 11 to 12 of coloring matter.

The coloring principle of turmeric is sparingly soluble in cold water, and dissolves freely in boiling. It is also soluble in alcohol. By alkalies it is turned brown, whence paper saturated with tincture of turmeric has long been employed as a test. Sulphuric, nitric, and hydrochloric acids turn the color of turmeric a kind of red, which, however, soon disappears. Alkaline chlorides for a time brighten the color, and solution of iron turns it brown.

The only adulteration to which turmeric is liable in commerce is common salt, which is sometimes added in quantity to the roots while going through the mill. This sophistication, besides adding to the weight, gives it a brighter appearance in the powder, at the risk of very seriously interfering with its uses in the dye house.

The detection of this fraud is easy. A small portion of the suspected powder is boiled in a test tube, with pure concentrated nitric acid, till the organic matter is destroyed. The remaining liquid is then diluted with pure water, and a solution of nitrate of silver added. If salt has been present, a copious white curdy precipitate will be formed.

The characteristics of a good turmeric are: it has a rich, deep, but bright, orange color, and a strong, aromatic, rather pungent odor. It should be perfectly dry. If damp it loses its brightness, turns a dull brown, and dyes only flat colors.

The best way of testing turmerics is to dye weighed pieces of woolen cloth with equal weights of the samples in boiling water. The swatches are compared for depth of color and examined for brightness overhand, *i. e.*, held up horizontally to the light and viewed along the surface. In this position it should have a beautiful golden luster, on the purity of which its value for many purposes depends.

Turmeric is a so-called substantive color, dyeing full shades without any mordant. It is, however, very fugitive, being affected by air and light as well as by acids and alkalies. A very remarkable circumstance is that no mordant hitherto known increases its permanency, while nearly all bodies of that class decidedly impair its beauty.