

The Heavens in February, 1916

Our Interesting Neighbor, Mars

By Prof. Henry Norris Russell, Ph. D.

NEXT to the solar eclipse of February 3rd—which was fully described in our last article—the most interesting event of the present month is the opposition of Mars, which occurs on the 9th.

The ruddy planet is at this time in the constellation Leo, about 18 deg. north of the celestial equator and, so far as his position in the heavens goes, very favorably placed for observation. As regards his distance from us, however, the present opposition is far from favorable—the closest approach of the two planets, on the day preceding the opposition, being 62,500,000 miles.

The orbit of Mars is decidedly elliptical, so that, though his mean distance from the sun is 141,000,000 miles, his greatest distance is 154,000,000, and his least only 128,000,000. The Earth's orbit is much more nearly circular, the greatest distance from the sun being 94,500,000 miles, and the least 91,500,000, and the two orbits are so disposed in space that the aphelion of the Earth—its remotest point from the sun and the perihelion of Mars—its nearest point to the sun—are nearly opposite to one another. If, therefore, the Earth passes between the sun and Mars at the time when Mars is in perihelion, the distance of the two planets is only 34,500,000 miles—the smallest possible value. Such a "favorable opposition" always occurs in the latter part of August, for it is at this time every year that the Earth reaches the appropriate point in her orbit.

At a February opposition, on the contrary, Mars is near his aphelion, and more than 60,000,000 miles outside the Earth's orbit—the present month furnishing an almost perfect example.

Since it takes the Earth a little more than two years to catch up with Mars, each successive opposition comes some 50 deg. farther east in longitude than the last, and the point of opposition works slowly round the sun, taking about 16 years to complete a circuit. Favorable oppositions therefore come at intervals of 15 or 17 years. The last one was in 1909, and the next—an unusually good one—will happen in 1924. After one of these dates the oppositions are successively less favorable for some eight years, and then gradually improve again.

At the present time Mars shows a telescopic disk a little less than 15 inches in diameter and appears to the eye like a star of magnitude—1.0—that is, three times as bright as Capella, and about 60 per cent as bright as Sirius. At a favorable opposition his diameter is fully 25 inches, and his magnitude is —2.7, making him nearly three times as bright as Sirius, and nearly five times his present brightness.

There are, however, certain observations for which the present opposition is valuable, for it is now summer in the northern hemisphere of Mars, and his northern temperate and polar regions are turned toward the sun, and are therefore visible, while the south pole is turned away and is invisible. At the favorable oppositions the reverse is the case. The south polar regions, and indeed the southern hemisphere generally can then be well studied; but the northern regions must wait for occasions like the present.

The possessor of a small telescope, though he may be disappointed in the small apparent size which Mars presents, can nevertheless see things of real interest, the darker areas which spot the generally ruddy surface, and the conspicuous white polar cap, shrinking as the Martian summer advances. The finer details, and notably the much discussed "canals," can, of course, only be seen with instruments of very high power.

The present Martian season is about half way from the vernal equinox toward the summer solstice, corresponding to the beginning of May on the earth. The polar cap is large, and shrinking rapidly, while, according to Dr. Lowell's latest bulletin, the northern canals are prominent, and the southern faint.

The Heavens

As our map shows the finest region of the evening sky is now in the southwest. Right overhead are the twin stars of Gemini, Castor and Pollux—the former white, and a fine telescope pair, the latter yellow and single. South of them is the still brighter star Procyon, in Canis Minor, while nearer, and to the southwest is the

planet Saturn, which is brighter than any of these three stars.

Lower down, in the south, is Sirius, brightest of all, with the remaining stars of Canis Major below and to the left. Southwest, and a little higher, is Orion, the finest group in the sky, and to the right of this, almost due west, is Taurus.

Northwest of the zenith is Auriga, with the brilliant Capella, second only to Sirius among the stars now in sight, while Perseus is lower down, and Cassiopeia still lower, and to the right.

Just north of east below the Pole are Draco and Ursa Major, rising toward the meridian. Below, a little north of east, Bootes has just risen and most of Virgo is also in sight a little farther south. Leo is high in the east, bearing Mars like a ball of fire in his forepaws, while Hydra, whose head is southeast of the zenith, trails downward to and below the horizon.

The Planets

Mercury, which was an evening star last month,

were the same, the brightness of parts of the two planets of the same apparent size would be in this ratio.

When allowance is made for the fact that part of the visible surface of Venus is not fully illuminated by the sun, it is found that the reflecting power, or "albedo" of the surfaces of the two planets is very nearly the same;—59 per cent for Venus and 56 per cent for Jupiter.

Mars is in opposition, as already described, and moves from Leo into Cancer during the month. He is visible all night long, and is by far the most prominent object in the eastern sky. Jupiter is an evening star, setting at 8:20 P.M. on the 15th, and visible, even before sunset, if one knows just where to look. Saturn is in Gemini, coming to the meridian about 9 P.M., and very well placed for observation.

Uranus is in conjunction with the sun on the 5th, and is quite invisible.

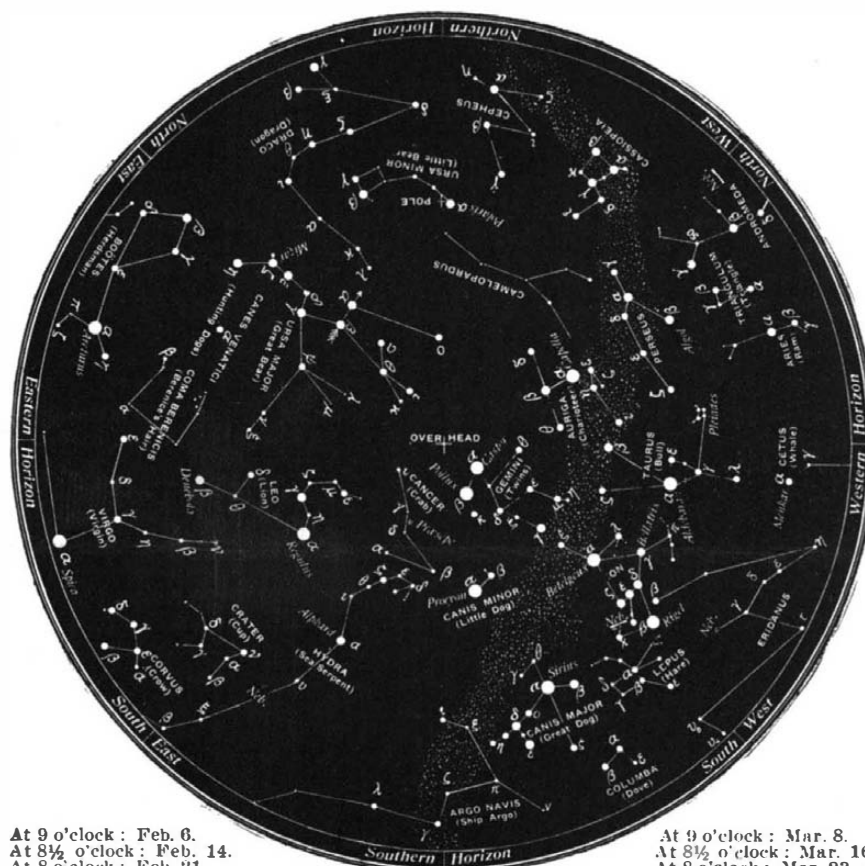
Neptune is just past opposition—his position on February 2d being R. A. 8h. 12m. 31s. Declination $+19^{\circ} 39' 14''$, and on March 1st 8h. 9m. 41s. $+19^{\circ} 48' 32''$. This places him about $1^{\circ} 50'$ north, and from $1^{\circ} 15'$ to $40'$ east, of the triple star Zeta Cancri, which itself is at the apex of a right-angled isosceles triangle whose acute angles fall on β and δ Cancri (shown on our map). To identify the planet without a detailed star-map it will be necessary to make a sketch of the faint star in the region and watch for the planet's motion. He is of magnitude 7.7—quite invisible to the naked eye—but can be seen with a good field-glass.

The moon is new at 11 A.M. on February 3d, in her first quarter at 5 P.M. on the 10th, full at 9 P.M. on the 18th, and in her last quarter at 4 A.M. on the 26th. She is nearest the Earth on the 1st, remotest on the 13th, and reaches her nearest point (perigee) once more on the 29th. On the 3d, she eclipses the sun, the eclipse being partial for the eastern United States, and lasting from about 10 A.M. to noon. She is also in conjunction with Uranus and Mercury on this day—both being very near the sun—with Venus on the 6th, Jupiter on the 7th, Saturn on the 15th, Neptune on the 16th, and Mars on the 18th.

Princeton University Observatory,
January 18th, 1916.

The Current Supplement

AN article on *The Construction of the Heavens*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, of January 29th, No. 2091, is an unusually readable survey of the progress of sidereal astronomy. *The Destruction of Historic Edifices in Europe* gives a few facts in regard to the irreparable injuries that have been inflicted on many famous public buildings. There are some pictures showing attempts at protecting the exterior decorations. *Searchlights in War* tells about some of the later and large electric outfits, and their various uses. The article is accompanied by excellent descriptive illustrations. An important paper at this time is the one on *Our Merchant Marine* that reviews its past history and future possibilities. In view of the proposals to establish government research laboratories the illustrated description of *The U. S. Naval Engineering Experiment Station at Annapolis* is timely, for comparatively few people are aware of what has already been done in this direction. *By-products of Gas Manufacture* gives notes on the recovery of hydrocyanic acid and its applications. *An Ingenious Electric Drive Gear* describes the operating mechanism of a gasoline motor car for use on branch line railways, a problem that is attracting attention in transportation circles. It is accompanied by several illustrations of the mechanism employed. *Zeppelin Airships* is a descriptive and historical address by the designer of these monsters of the air, together with some discussion of the subject. There are several appropriate illustrations. *Oil-Mixed Portland Cement Concrete* gives useful information in regard to the preparation and use of a valuable building material. The paper on *The Improvement of the High-Boiling Petroleum Oils* is concluded. There are also several shorter articles of general interest.



At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.

At 9½ o'clock: March 1.

At 9 o'clock: Mar. 8.
At 8½ o'clock: Mar. 16.
At 8 o'clock: Mar. 23.

NIGHT SKY: FEBRUARY AND MARCH

passes between us and the sun—though considerably north of the direct line—on the 5th, and becomes a morning star. He will be well visible at the end of the month, and reaches his greatest elongation on March 1st when he is 27 deg. east of the sun; and rises about 5:30 A.M.

Venus is an evening star, growing brighter as she approaches the Earth and more conspicuous as she gets farther north. Telescopically, she shows a gibbous phase, like the moon, four or five days from the full. To the naked eye, the most notable event will be the conjunction with Jupiter on the evening of the 13th. The two planets are then only four tenths of a degree apart, and will form a very striking spectacle, on account of their great brilliancy. Venus appears nearly two magnitudes brighter than Jupiter—that is, about six times as bright. Nevertheless, when viewed telescopically, Jupiter will be found to appear of more than twice the apparent diameter of Venus, and more than five times her "angular area," even if the whole disk of Venus were visible. As only a little more than three quarters of the illuminated surface of Venus is visible, the actual ratio of the angular areas of the two planets is seven to one in favor of Jupiter. It follows that, for equal apparent areas, the surface of Venus appears to be more than forty times as bright as that of Jupiter. The reason for this is obvious. Jupiter is 460,000,000 miles from the sun, and Venus only 67,000,000. The intensity of the sun's light varies inversely as the square of the distance, so that Jupiter, per square mile, gets only one forty-seventh as much light as Venus does, and, if the actual reflecting power of their surfaces

Apparatus for Demonstrating the Motion of Gas Molecules

MUCH credit is due Dr. Edwin F. Northrup of the Palmer Physical Laboratory, Princeton University, Princeton, N. J., for developing what is believed to be the first mechanical apparatus ever designed for fully and successfully illustrating, in a visible way, the motion of gas molecules and the principles which govern these motions as laid down in the kinetic theory of gases, and for the verification of some of the theorems of this theory with quantitative measurements.

The apparatus consists essentially of a circular metal base, supported on three legs provided with leveling screws, on which rests a glass cylinder with open ends. A metal ring rests upon the top of the glass cylinder. Various attachments can be made to this ring. When

the apparatus is used for illustrating the motions of gas molecules and the pressure produced on the walls of the container by molecular impact, there is suspended from a cross-piece attached to the metal ring a floating disk of glass. This glass disk is capable of free motion, in the manner of a piston-head, within the glass cylinder. The glass disk is ordinarily located a little above midway between the bottom and top of the glass cylinder. In the volume enclosed by the glass cylinder between the base piece and the floating glass disk, approximately 16,000 steel balls of 1-16-inch diameter are maintained in motion in the manner of gas molecules. The distribution of the balls throughout the volume in which they move is perfectly uniform. The motion of the balls is produced by means of four metal rotors which rest upon the metal base and rotate in the horizontal plane; two of them rotating in a clockwise and two in an anti-clockwise direction. The impact given the steel balls by the revolving rotors causes them to be in constant motion, simulating the action of gas molecules. Power for driving the rotors is derived from a small electric motor. Underneath the steel plate of the apparatus are four intermeshing gear wheels and a pulley for belt attachment to the motor.

The Northrup visible molecules apparatus, as it is termed, together with its accessories is designed to illustrate in a striking and convincing manner the following fundamental properties of a nearly perfect gas: First.—The change of pressure of a gas when the volume is maintained constant and the pressure changes. Second.—The change of volume of a gas at constant pressure with change of temperature. Third.—The property known as the viscosity of a gas—a property which is exhibited in all gases when the oscillations of an oscillating system suspended in a gas are damped out. Fourth.—The property possessed by a gas (and a liquid) of causing the irregular motion of small particles suspended in the fluid, known as Brownian movements. In the accompanying illustrations the accessories required for the different demonstrations, as well as the method of arranging the apparatus, are shown.

Unique Sleeping Room Reached by One-Passenger Elevator

THE city engineer of a small town in California, who desired to spend his sleeping hours above the sultry air of his bed-room, hit upon the ingenious scheme of building an elevated sleeping apartment, far enough above the ground so that there would be a noticeable change in the temperature and the purity of the air. The net result of his efforts is veritably a nest in an iron tree, for he erected four stout iron pipes, braced them se-

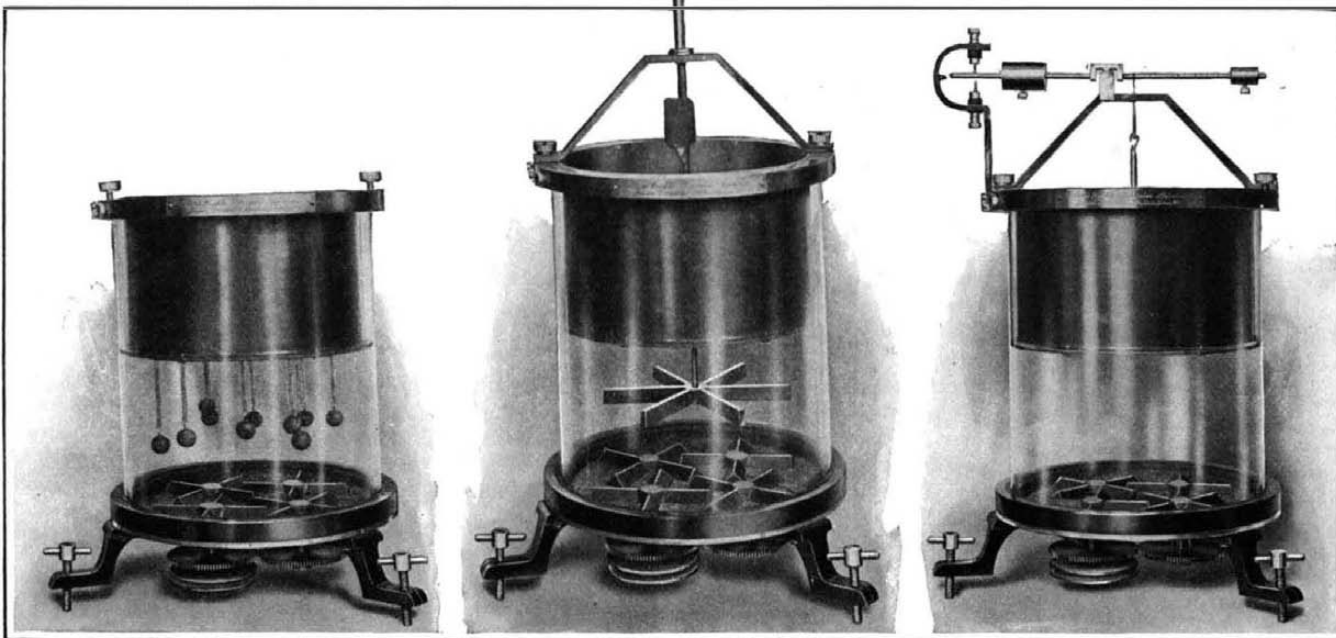
curely and built a com at the top. The dis ground and his bedroom and it is safe in all Its builder estimates 200 mile-an-hour hurri from the principle of

fortable sleeping room tance between the floor is nearly 40 feet, weather.

that it will withstand a cane with ease. Aside the idea itself, probably

respect the instrument is self-contained. The dry battery is renewable at small expense; its life being more or less problematical since it depends entirely on the service to which the indicator is put. The inventor states that he has used an indicator daily for over three months before renewal of the battery became necessary, and this may be considered a fair average.

In use, the electric test indicator is applied in the same manner as the usual gages, but instead of watching the contact of the needle of the surface gage with the work being trued up in any machine tool, the workman is only obliged to watch for the flash of the electric lamp. The moment the ball point of the needle touches the highest point of the work in hand, either internal or external, the light in the end of the tube flashes. Thus there is indicated the direction in which the job must be moved, and after the work is perfectly true the light burns continuously.



Visible molecules apparatus developed by Dr. Northrup, arranged for different demonstrations of the principles of gas molecules

At the left: Apparatus arranged with suspended wooden balls for illustrating the Brownian movements. Center: Set up of the apparatus with steel disk, rod and iron hub for illustrating viscosity of a gas. At the right: Apparatus assembled to illustrate and demonstrate changes in pressure, at constant volume, of a gas, when the temperature changes.

the most unique feature is the means for reaching the lofty sleeping room. A small, box-like elevator, guided by a two-inch galvanized iron pipe, is lifted by the strength of a one-sixth horse-power electric motor. Screens enclose two ends of the house, so that the ventilation nearly approaches that to be had by sleeping in the open on the hill-top.

Electric Test Indicator for Surface Gage

TO eliminate the strain on the eyes which accompanies the employment of an ordinary surface gage used by machinists and toolmakers, there has been

The indicator is claimed to be very sensitive and even the lightest touch of the needle causes the light to be flashed on. A special holder is provided for the indicator, permitting of its use in the tool-post of a lathe or other machine, where it may be inconvenient to use a surface gage.

Paper and Charcoal from Hopvines

GERMAN scientists are certainly leaving no stone unturned in their efforts to assist the Fatherland to utilize every possible product which can be turned into a national asset. One of the latest announcements made is that hopvines may be made to yield an excellent quality of fiber for use in jute mills and paper mills, and likewise charcoal for powder. In the *Chemiker Zeitung* (Cöthen) August 7th, Otto Reinke states the result of his researches on the subject as follows:

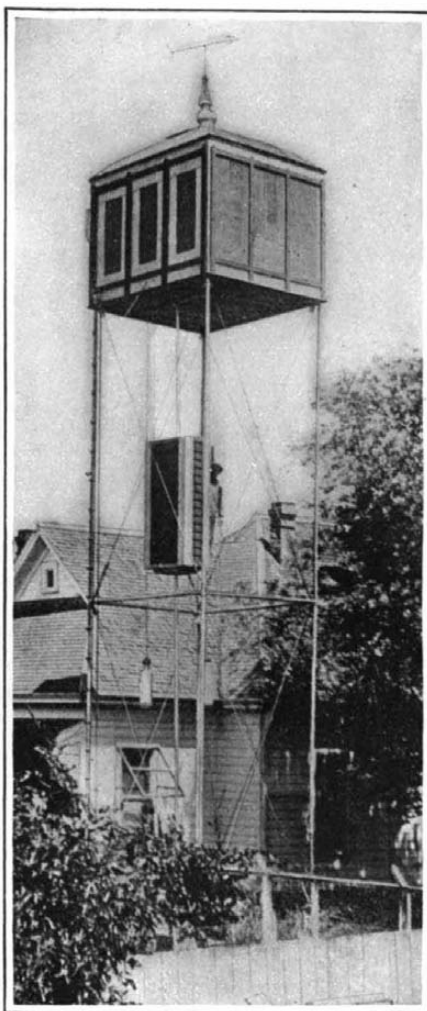
"Willow-bark does not yield good fiber, the fiber being too closely surrounded. The broom-plant is not available, since if over treated with steam or soda-lye the fibers are too short and too weak, and like willow and hopvines it cannot easily be stripped except when treated with steam or a 0.5 per cent solution of hydrochloric or sulphuric acid, while in spite of this the fiber remains too much incrustated to be satisfactory to our manufacturers of jute. I, therefore, began to experiment with the hopvine, which is available in large quantities, since our breweries use 500,000 heads of hops yearly in making beer, and the yield is about 8,000 plants per hectare.

"The fiber is difficult to isolate by means of lye, but can be easily stripped after softening in a 0.5 per cent solution of inorganic acid, as also by steam at about 0.5 at. But since old vines, when allowed to lie long in the open yield fiber free of the incrusting substance and easily stripped, obviously this method is preferable, or better still, artificial layering in warm damp piles or layers."

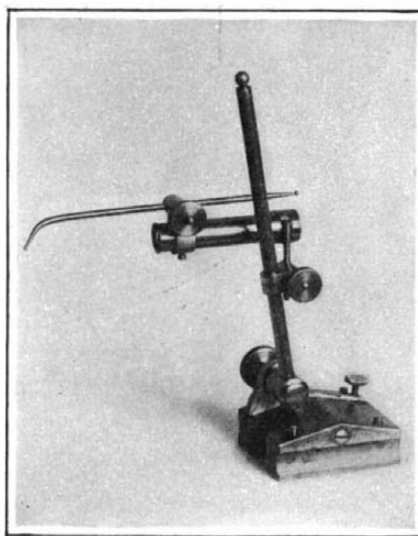
By this method Mr. Reinke obtained a yield of 20 per cent of good fiber. The remaining wood, when treated with a 6 per cent solution of soda-lye at 3 at. gave exceptionally good paper fiber. From the roots also very beautiful long-fibered paper material was produced.

The wood of the vine, which is hollow, was dried and subjected to dry distillation and carburization. At 330 deg. Cent.

beautiful red and brown charcoal was obtained, exhibiting the qualities demanded in good powder charcoal. Mr. Reinke therefore urges all patriotic hop-growers to pile their cut vines and allow them to be rained on and to ferment, and afterwards to dry for the sake of the fiber and charcoal obtainable.

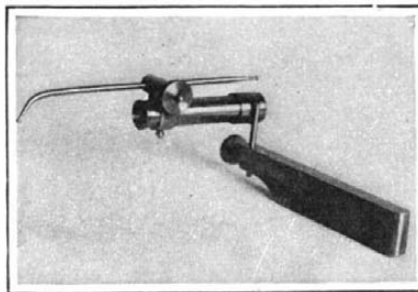


Elevated sleeping apartment built by California engineer



Electric test indicator mounted on usual surface gage

It will be noticed that this device is entirely self-contained, and no connecting wires are necessary



Electric test indicator mounted on a tool rest piece

devised an electric test indicator of simple design.

The device, which is shown in the accompanying illustrations, is the invention of J. G. Xander of Reading, Pa. It consists of a main body containing the battery and electric bulb, a gaging needle and the holding member. There are no connecting wires, and in every other