THE HEAVENS IN SEPTEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

If we look directly upward early on a clear September evening, we will see the heavens just as they are shown on our map. Right above us is the fine constellation of the Swan—a great cross of stars in the Milky Way. West of it, and near to it, is the Lyre, with one very bright star, Vega (marked with the letter *a* on the map).

Following down the Milky Way to the southwest, we come to the Eagle (Aquila), whose brightest star, Altair, is nearly equal to Vega. Below this is the brightest and finest part of the Milky Way, which is almost startlingly brilliant on a thoroughly clear night. Even an opera glass shows that it is full of groups and clusters of stars, and those who have telescopes, of whatever size, will find it a happy hunting ground, full of magnificent fields. It extends far down to the southwest, where the constellations of the Scorpion and the Archer are beginning to set.

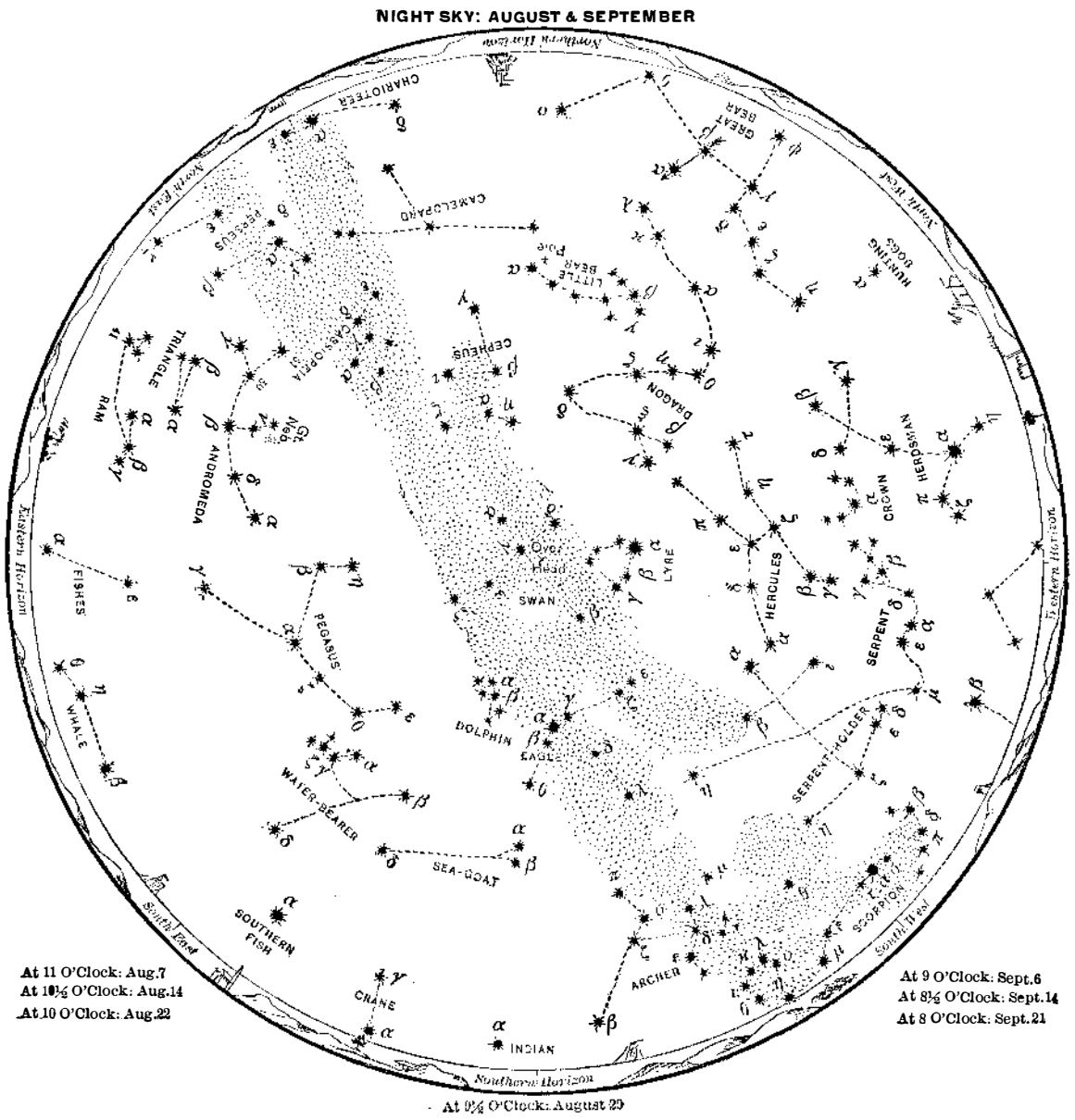
In the western and southwestern sky are the Serpent Holder (Ophiucus) and the Serpent, which, like Hercules to the north of them, can be studied better from the map than from any description. Below Hercules is the Northern Crown, and beneath this the Herdsman, with the great red star Arcturus. The Dragon and the Little Bear are to the left of the Pole, and the Great Bear is below them, so that the Dipper lies along the northwestern horizon. Cepheus and Cassiopeia are on the right of the pole and above it, toward Cygnus.

East of the Milky Way stretches a row of fine constellations. Due east, and about half-way up to the zenith, is Pegasus, which can be known at once by the "great square," whose four stars are all of the second magnitude. The northeastern one belongs not to Pegasus, but to Andromeda, which extends far to the northward and eastward. Still further on in the same direction we reach Perseus and then Auriga, the Charioteer, whose brightest star, Capella, is just rising.

The most interesting object in Andromeda is the great nebula, which is marked on our map, a few degrees northwest of β Andromeda. It is visible to the naked eye, and conspicuous in a field glass, but the marvelous concentric spirals which form its outer portions are revealed only by photography.

Below Andromeda is the small group of the Triangle, and the smaller but brighter one which marks the head of Aries, the Ram.

The Zodiacal constellations of the Fishes (Pisces), the Water Bearer (Aquarius), and the Sea Goat (Capricornus), which lie in the southeastern sky, contain no bright stars. The planet Saturn is now in Aquarius, and is much brighter than any star near it. It lies almost on the line of the western edge of the great square of Pegasus, extended southward. Farther down, in this same line, is a solitary bright star, Fomalhaut, in the Southern Fish.



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

THE PLANETS.

Mercury is morning star at the beginning of the month, rising at about 4:30 A. M. On the 4th he is in conjunction with Mars, passing him at a distance equal to one-third of the moon's apparent diameter. Both planets are near the bright star Regulus and soon pass north of it at a distance of less than a degree.

During the latter part of the month Mercury is invisible and on the 24th he passes behind the sun and becomes an evening star.

Venus is evening star in Virgo, and is very bright. On the 20th she is at her greatest elongation—that is, her apparent distance from the sun is greatest. She is, however, far south of the Sun, and is not nearly as conspicuous as at a spring elongation, but sets at about 8 P. M.

Mars is morning star in Leo, rising about 4:30 A. M. Jupiter is in Gemini, and rises near midnight in the middle of the month.

Saturn is in Aquarius, and comes to opposition on the 4th. He is now in a better position for observation than for several years past, and will well repay any one who turns a telescope upon him. The Earth is getting near the plane of his rings, so that we see them much more nearly edgewise than last year. A few years ago they appeared as an oval about half as wide as it was long. Now the length of the ellipse is ten times its breadth, and the rings seem to stick out on each side of the ball of the planet like handles. In another year we will see them edgewise, and they will then disappear entirely, except in very powerful telescopes, to broaden out again in the year following, when we see their opposite side.

The brightest of Saturn's nine satellites, Titan, may be easily seen with a small telescope. It is west of the planet on the 5th and 21st, and east of it on the 13th and 29th (its period being sixteen days). When it is north or south of the planet it now seems so close to it (less than the planet's diameter) that it will be hard to see it with a small instrument.

Uranus is in Sagittarius and is in quadrature on the 28th, coming to the meridian at 6 P. M. Neptune is in Gemini and can be observed before sunrise.

THE MOON.

Full moon occurs at 6 P. M. on September 2, last quarter at 4 P. M. on the 10th, new moon at 7 A. M. on the 18th, and first quarter at 1 A. M. on the 25th. The moon is nearest us on the 21st, and farthest off on the 9th. She is in conjunction with Saturn on the 2d, Jupiter and Neptune on the 12th, Mars on the 16th, Mercury on the 17th, Venus on the 21st, Uranus on the 24th, and Saturn again on the 30th.

The conjunctions with Saturn are close, and occultations are visible in the southern hemisphere.

At 6 P. M. on the 23d the sun crosses the celestial equator and enters the sign of Capricorn, and in the old expression of the almanac, "autumn commences."

THE USE OF CLAY CONES IN STEEL HEATING.

The days of estimating the heat of a work-piece by the color have gone by—at least in establishments where any weight is laid on uniformity of product. In the first place, no two men will agree as to the color of a piece in any one fire or bath; in the second, the same temperature will be differently estimated in different parts of the shop or at different times of the year—or even day; and in the third place (what is of equal importance), no two steels will show the same color for the same temperature. Something more exact must take the place of the eye. There are some good pyrometers, but they are generally expensive and delicate, and inconvenient to apply. But there is a means of measuring—not estimating—temperature, which manufacturers of fine porcelain use, which should be of great value to steel workers in enabling them to ascertain with certainty just what the temperature in a furnace really is, instead of guessing at it. And here we may add what we should have given as fourthly above—that the eye grows tired and less sensitive to color; so that the same temperature will be estimated lower, after ten minutes' watching red or white hot metal or combustible.

The method to which we refer consists in the use of porcelain—or rather clay—cones of various melting or softening points; there are about sixty different grades, each stamped with a number corresponding to a definite temperature at which slumping down takes place. The range of temperature is between 590 deg. and 1,940 deg. C., or say 1,094 to 3,524 deg. F.

In order to find out which cones to use, where the right temperature is not known in degrees, the first test is made with several cones, and that one is chosen as the standard which at the desired temperature curls over and nearly or quite touches the floor of the furnace. It is best to use two cones of the proper number, one for the hottest and the other for the coolest part of the furnace; their curling over is to be watched through the usual peep-holes, preferably covered with mica. The cones should be protected from direct flame, just as much as the work-pieces are. A good way is to fence them around with two bricks on the side and one on top, the cone also standing on a brick. Another way is to use open-sided clayware hoods provided for the purpose, and which melt at a higher point than any of the cones. There are also small muffles which serve the same purpose, as well as capsules with lids; these latter, of course, must be drawn from the furnace in order to observe the cones.

Just why the cones now used are not marked with the melting temperatures instead of numbers ("022," "09," "29," etc.), "deponent saith not, not knowing"; perhaps some wire-gage manufacturer can give the reason.

"GALVANIZING" WITH ZINC-ALUMINIUM ALLOY.

In order to get a "galvanizing" bath that shall be quite liquid and yield a brighter surface than is attainable by the use of zinc alone, Gührs uses an alloy composed of about one-half of one per cent of aluminium, and one-fifth per cent of bismuth with the zinc. In order to get this alloy in proper state of diffusion it is necessary to melt the aluminium at the same time with the zinc; the bismuth can be melted in at the same time if desired. It is claimed that simultaneous melting of the zinc and the aluminium prevents the formation of oxide and of hard dross. In order to effect this desirable simultaneous melting of these two metals, it is best to prepare beforehand an alloy of zinc and aluminium, or of these with bismuth, in stronger proportions of aluminium than is desired in the bath—for instance, 20 parts of aluminium and the same of zinc, with 5 of bismuth, well stirred while melting. This "mix" is to be melted with the rest of the zinc, in such proportions as will give to the resulting melted mass the requisite proportions for the bath.

A higher percentage of aluminium can be used than one-half (one two-hundredths of the entire weight), but it effects no improvement above that brought about by the use of the smaller quantity. The bismuth may be used in even smaller quantities than the above-quoted one-fifth of one per cent.

An American patent has been granted for making pens of tantalum or its alloys.