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 α 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.

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.

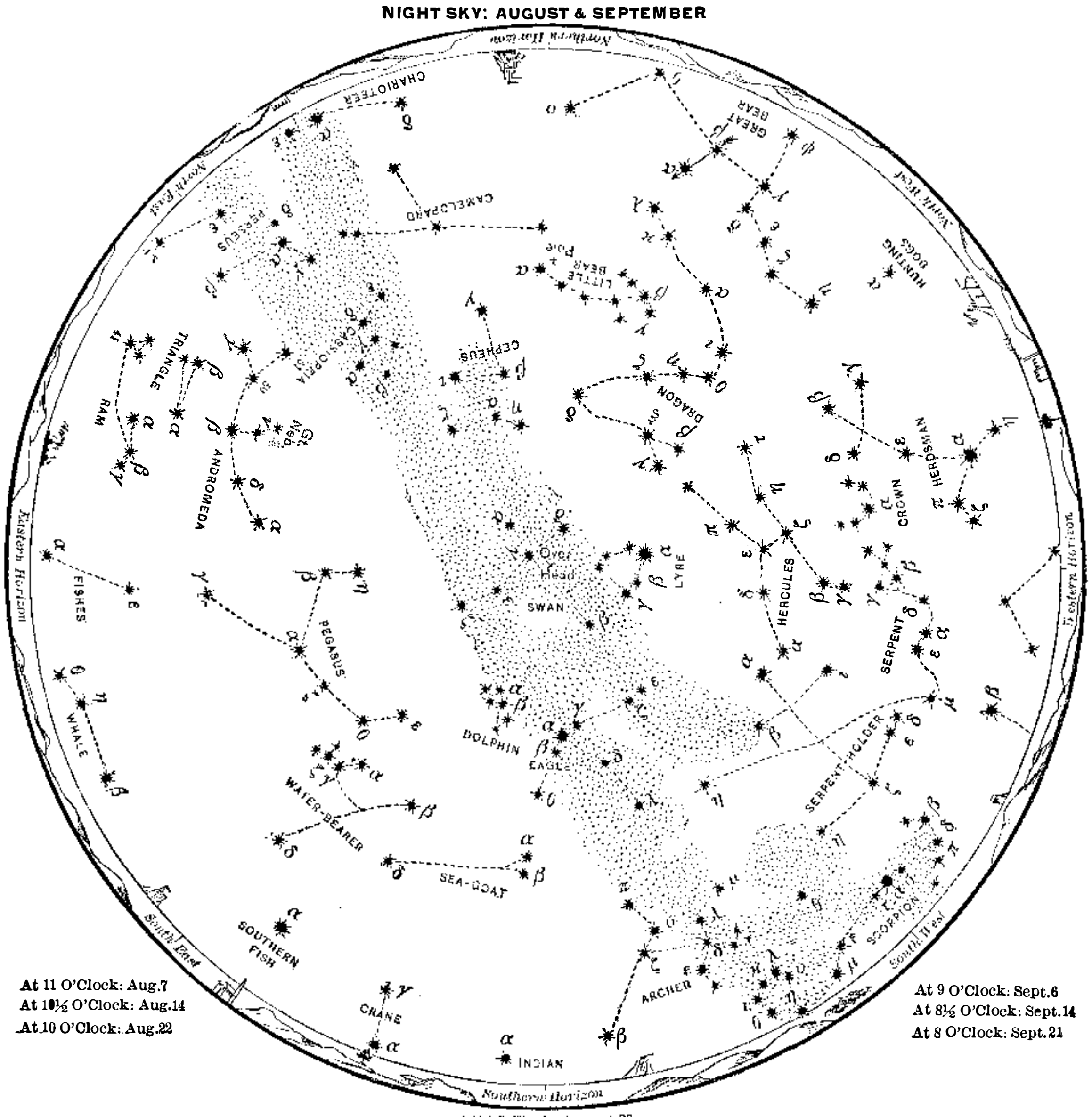
Mars is morning star in Leo, rising about 4:30 A. M. Jupiter is in Gemini, and rises near midnight in the middle of the month.

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.

NIGHT SKY: AUGUST & SEPTEMBER



At 11 O'Clock: Aug.7
At 10½ O'Clock: Aug.14
At 10 O'Clock: Aug.22

At 9 O'Clock: Sept.6
At 8½ O'Clock: Sept.14
At 8 O'Clock: Sept.21

At 9½ O'Clock: August 29

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 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.

SANITATION OF THE CITY OF WASHINGTON.—I.

BY BEN. WINSLOW.

THE AQUEDUCT AND FILTRATION PLANT.

The average annual death rate of the city of Washington, according to the Twelfth Census, is with one exception the highest of all the cities of the United States having a population of over 100,000. The average annual death rate of Washington for the period covered by the last census is 23.09 per 1,000 population, while the average for cities of approximately the same size is about 17 per 1,000. In the table of annual death rates per 100,000 population due to typhoid fever in cities of the same class, Washington stands first with 78, which is 20 higher than Cleveland, the next highest city on the list. The capital city of the nation is now nearing the end of a costly effort to reduce its abnormally high death rate to a more reasonable figure, and the work has been done so quietly that the citizens know little of it.

Long before the city even dreamed of a filtration plant; before the use of any filters for water, except probably inadequate and unsatisfactory individual devices, the city of Washington struggled with the momentous question of pure drinking-water supply. Major L'Enfant, under the direction of Gen. Washington, made numerous surveys, to "ascertain the practicability of obtaining a full supply of good water for the federal capital," but it was a long time before the idea of bringing the city's water fifteen miles was considered with any degree of seriousness.

The immense volume of water discharged over the Great Falls of the Potomac, situated fifteen miles above the city, marked that place as the future source of water supply many years before those in authority finally obtained the necessary means and sufficient courage to attempt what was then considered an almost impossible task. The expense was the greatest stumbling block to the Great Falls project, the estimated cost being so great that it staggered the young government; and although some surveys were made by order of Congress in 1850, owing to the lack of sufficient funds the Great Falls project was not gone into at any length, the surveys and investigations of the Topographical Corps having been confined to the Rock Creek proposition. Col. Hughes, who reported the results of the surveys, contemplated the building of a dam which would give a supply of about eight million gallons of water from Rock Creek per diem.

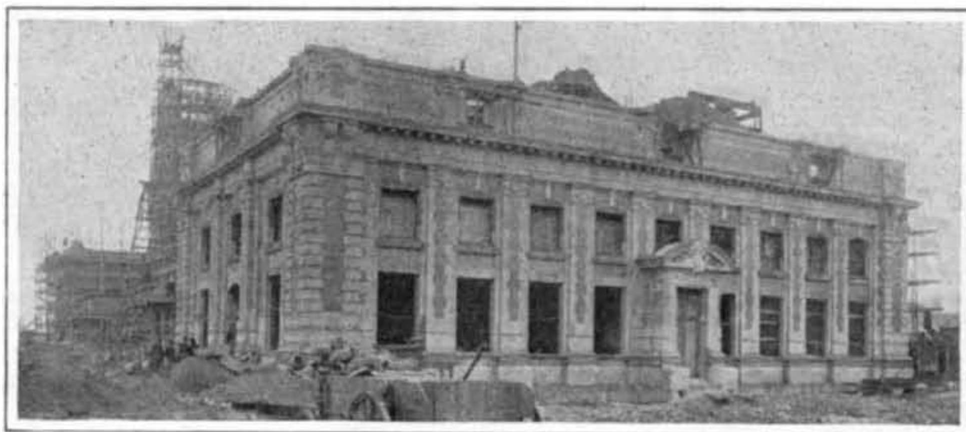
The population of Washington at that time was forty thousand, and this volume or water was considered sufficient to supply the city for the next forty years. The proposed daily supply was one and a half million gallons, or over thirty gallons per capita per diem. In addition to the dam, it was proposed to build a sedimentation reservoir on "Mederian Hill," and a distributing reservoir, "to be established just back of Franklin Road, the highest ground in the city." "Just back of Franklin Road" was then a considerable distance from the city; but now it is in the heart of it.

The Great Falls proposition originated with Capt. M. C. Meigs, of the Corps of Engineers, U. S. A. The Rock Creek project having been discarded, Congress in 1852 appropriated five thousand dollars to "enable the President to devise a plan for supplying the city with an adequate water supply," and surveys were made ove the Great Falls route during the winter of 1852-53. Congress at its next session passed a resolution which put the selection of plans in the hands of the President, and it also voted to defray from the Treasury the cost of any project he approved. The President accepted the Meigs plan, which called for a nine-foot conduit from Great Falls.

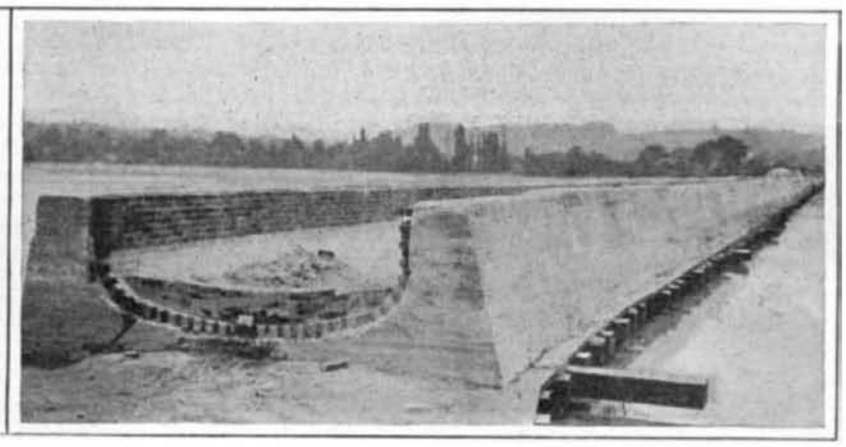
To hold the water at a proper level a dam was constructed at Great Falls, with its comb one hundred and forty-five feet above high tide at Washington, and from this dam the water was conducted through a circular conduit of brick, nine feet in diameter and having a fall of nine and one-half inches to the mile. In order to shorten the conduit and save expenses, a receiving reservoir was formed by damming the Little Falls Branch, a tributary of the Potomac, situated about five miles from Washington. With an area of little over fifty acres, it has a capacity of approximately eighty-five and a half million gallons, and is used for both storage and sedimentation. A distributing reservoir was constructed on the heights of Georgetown, about two miles from Washington, and connected with a receiving reservoir by a continuation of the conduit. The system was completed in 1863, and has been in continuous successful operation ever since.

One of the greatest problems that confronted the engineers was the placing of the conduit beneath the rock bluff which skirts the river from a point about a mile and a half below Great Falls to the intake at the dam. All but about a mile and a half of the conduit is laid under one of the finest roadways in the country. It is known as the Conduit Road, and is kept in prime condition by the War Department.

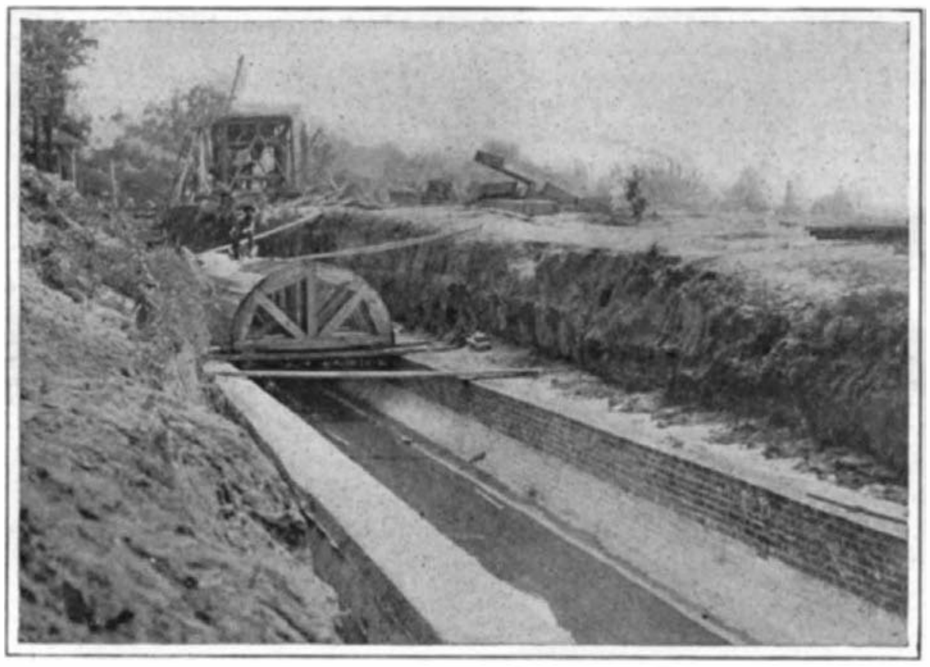
The famous Cabin John bridge, which, until the construction of a rival in Germany, was the largest single-arch stone bridge in the world, carries the conduit over Cabin John Run, and the Pennsylvania Avenue bridge, built on arches formed by the two mains which lead from the distributing reservoir to the city, carries the water over Rock Creek. The greater part of the water, however, now flows through the famous Lydecker tunnel to a reservoir on the heights to the north of the city, from which it is pumped into the new filter beds, and thence distributed throughout the city as pure water.



A Completed Section of the Pumping Station.



Laying the Outfall Sewer Across the Swamp Lands.



The Dry Land Continuation of the Outfall Sewer.

Breaking Ground. An Orange Peel Shovel Beginning the Work of Excavation.

The Portals of the Twin Tunnels Which Cross the River.

SANITATION OF THE CITY OF WASHINGTON.—I.