of over a thousand sections is carefully taken down and the model is lifted from its resting place upon the lowest flask section. The mould is next rebuilt, the inner surface receiving a coating of foundry facing, and the interior is rammed full of clay to form the core. This core need not be solid. Some spaces may be left in it for the gases to collect in. Thus the mould is a second time complete and intact, but is filled with a clay figure instead of a plaster one.

The mould is a second time dismantled and the core is taken in hand. From its entire surface a layer of clay is removed, to average, as nearly as possible, one quarter of an inch in depth. This delicate operation provides the space for the metal to occupy in the casting process. This core thus reduced in size is replaced upon the flask and is properly supported. The mould is a second time built up, surrounding in this case the reduced core. A number of channels or gates are worked in the mould to allow the metal to run through to different parts of the figure. These resemble somewhat the trunk and branches of a tree. They start of comparatively large section near the pouring reservoir, and fork and diminish repeatedly, reaching the space between core and mould in many places. When all is perfectly dry, and the flask filled with sand so as to hold all the pieces in place, the operation of casting is proceeded with. In the present case seventeen weeks were required for the moulding.

The process of casting a bronze statue is executed either by surface or bottom casting. In the latter method a reservoir is arranged over the gates, which reservoir is large enough to hold all or a large portion of the metal. It has holes in its bottom corresponding exactly to the gates in the mould. These holes are plugged. The metal is poured into the reservoir, and by withdrawing the plugs the metal runs down into the space in the mould. The Beecher statue was cast by surface pouring. The metal held in crucibles was poured directly into the gates. This enabled a constant watch to be kept upon its fluidity and general nature as far as shown in its fusion. A man, as the metal was poured, kept scraping back all scoria, slag, and oxide from its surface. The adoption of one or the other system of pouring the metal rests, as a matter of preference, with the individual founder.

For the Beecher statue 7,400 pounds of metal were melted repeatedly. The fourth fusion was the one used. Eleven minutes were occupied in the casting, and the finished statue weighed 3,600 pounds. The rest of the metal represented the contents of the gates, waste, etc. The alloy was composed of copper 90 parts, tin 10 parts, zinc 3 parts.

The Beecher statue will be unveiled about the time this paper reaches our readers. The artist is J. Q. A. Ward, and the statue will, in the artistic and mechanical sense, be a credit to its eminent artist and to its founders.

Angina Pectoris—Its Nature.

Dr. R. Douglas Powell, in *The Practitioner*, argues that angina pectoris is a disturbed innervation of the heart or vessels, associated with more or less intense cardiac distress and pain, and a general prostration of the forces, always producing anxiety, and often amounting to a sense of impending death, and concludes that :

1. In its purer forms we observe disturbed innervation of the systemic or pulmonary vessels, causing their spasmodic contraction, and consequently a sudden extra demand upon the propelling power of the heart, violent palpitation or more or less cramp and paralysis ensuing, according to the reserve power and integrity of that organ—*angina pectoris vasomotoria.*

2. In other cases we have essentially the same mechanism but with the extra demand made upon a diseased heart—*angina pectoris gravior.*

3. The trouble may commence at the heart through irritation or excitation of the cardiac nerves, or from sudden accession of anæmia of cardiac muscle from coronary disease—*primary cardiac angina.*

4. In certain conditions of blood or under certain reflex excitations of the inhibitory nerves, always, however, with a degenerate feeble heart in the background, we may observe intermittence in its action prolonged to syncope—*syncopal angina.*

Artificial Gold.

There are a great many metallic substances known for producing metal closely resembling gold. The *Western Jeweller* gives the following formula for producing one of the artificial gold substances :

Take 100 parts (by weight) of pure copper, 14 parts zinc or tin, 6 parts magnesia, 56 parts sal ammoniac, 18 parts quicklime, 9 parts cream of tartar. Melt the copper, and add gradually the magnesia, sal ammoniac, quicklime and cream of tartar, each by itself, in the form of powder. Stir the whole for half an hour, add the zinc or tin in small pieces, and stir again till the whole is melted. Cover the crucible, and keep the mixture in a molten condition for thirty-five minutes. Remove the dross, and pour the metal into moulds. It has a fine grain, is malleable, and does not easily tarnish.

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Contents.

(Illustrated articles are marked with an asterisk.)

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For the Week Ending June 27, 1891.

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ARCTURUS.

This brilliant star in the constellation of Bootes, now visible nearly overhead in the evening hours, was the subject of a very interesting lecture by Mr. Wm. H. Knight, recently delivered before the Cincinnati Society of Natural History. We give herewith a few extracts from the paper, which will appear in full in our next week's issue of the SUPPLEMENT:

Within the last two or three years a new and surprising value has been given to the parallax of Arcturus by Dr. Elkin, the astronomer of Yale University. Previous to his work at Yale he had acquired a reputation for painstaking observations and accurate results in the British observatory at the Cape of Good Hope. Equipped with a 7' heliometer provided with the latest improvements, he set himself the task of measuring the parallax of several prominent stars. Devoting himself specially to Arcturus, from no less than 89 observations, taken in connection with 10 comparison stars, he deduced the very small parallax of $\frac{18}{1000}$ or about $\frac{1}{55}$ of a second of arc, which is equivalent to a distance of 181 light years. This minute parallax (which is assumed to be approximately correct by other astronomers), combined with its large proper motion, gives Arcturus the tremendous velocity of 381 miles per second—a distance 40 miles greater than that which separates Cincinnati from St. Louis. Imagine a body moving from this city to the Mississippi River between the ticks of a clock.

Now, Dr. Elkin admits that there is what is technically called a "probable error" in his observations, but that error is + or —, and would be as liable to make the value of the parallax less than the figure named as to make it more. So that while the velocity of Arcturus *may* be 50 or even 100 miles less per second than computed, it may *possibly* be 50 or 100 miles more.

But until we get new data, based on more extended observations, made with better instruments, we may, in company with the leading astronomers of the world, accept Dr. Elkin's startling figures, and consider Arcturus as 181 light years away, and rushing through space with the unparalleled velocity of 381 miles per second, or about 21 times faster than the earth travels in its orbit around the sun.

Is such a velocity impossible ? Is it incredible ? Is unreasonable ?

It has been mathematically demonstrated that the velocity with which matter, drawn from distant space, would fall upon the surface of the sun is no less than 383 miles per second, a velocity, it will be seen, almost identical with that of Arcturus.

Many comets which come from interstellar regions and visit our solar system sweep around the sun at perihelion with velocities even higher than that ascribed to Arcturus, and, moving in parabolic curves, again plunge outward into distant space, and passing beyond the dominion of our own sun, enter that of some other mighty star.

Thus far I have been considering the velocity of Arcturus *perpendicular* to or *across* the line of sight. But we have seen in the case of Sirius, that while it is moving with the comparatively low speed of 9 miles *across* the line of sight, it is receding *along* the line of sight with the high velocity of 20 miles per second. How is it with Arcturus ? Is he approaching or receding from us ? Mr. Huggins again comes to our aid with his spectroscope, and finds that, while Sirius is moving *away* from us at the rate of 20 miles per second, Arcturus is rushing down *upon* us with the far higher velocity of 55 miles per second.

But we need have no fear of a collision. While he will doubtless continue to approach us for tens of thousands of years to come, till he arrives within 140 light years or so, he will then, after a computable period gradually and then rapidly recede from us and from our part of the sidereal universe, and pursuing an unswerving course, with unabated velocity, he will, in a few million years, pass entirely out of the ken of the most powerful earthly telescope. For, while Arcturus is now approaching us at the rate of 55 miles per second, he is moving athwart our line of vision 381 miles in the same moment of time.

But *part* of that apparent motion of approach on the part of Arcturus is caused by the movement of our *own* sun, which, with its train of attendant worlds, swinging along through space at the estimated rate of 15 miles per second. Its course is directed toward the constellation Hercules, between Acturus and the Milky Way.

And now, having obtained some idea, however crude, of the great distance and rapid motions of this remarkable star, we are curious to learn something of his magnitude and physical structure. If he had a visible companion circling around him, as is the case with Sirius, Alpha Centauri, and some other stars which exhibit a measurable parallax, we could weigh his mass, or rather the combined mass of the two bodies, and thence infer his probable magnitude. But Arcturus is a solitary star. No telescope has revealed any attendant companion.

Our only resource, then, is to compare his light-giving power with that of other luminous bodies, and accept such conclusion as may be fairly drawn.

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There are three well defined classes of stars, judged by the quality of light they yield. In the first class are the clear white and bluish white stars like Sirius and Vega. These are supposed to be the hottest stars and the most luminous in proportion to the extent of their surface. Then there are the golden yellow or pale orange stars, of which Arcturus and Capella are fine examples. These have begun to cool. Finally, we have the deep orange and red stars like Aldebaran and Antares. These have advanced still further in the cooling processs.

Now the spectroscope informs us that our sun belongs to the orange or Arcturus type, and if we could view it from distant space, we should see a lovely star of a pale golden yellow. The question arises, then, how far would our sun have to be removed in order to shine with a brightness no greater than that of Arcturus? According to Mr. Maunder, it would have to be removed to 140,000 times its present distance, or about half the distance between us and Alpha Centauri.

But Arcturus is 11½ million times as far away as the sun, and if our sun were placed at that enormous distance, its diameter would have to be 82 times as great in order to give a light equal to that received from Arcturus. I hesitate to present such figures, implying magnitudes far beyond any to which we have been accustomed, yet they are but the logical deductions of observed facts. In other words, upon Mr. Maunder's reasonable assumption, Arcturus must be a gigantic sphere, 550,000 times larger than our sun, with a diameter of seventy million miles, or more than large enough to fill the entire orbit of Mercury.

To make this contrast clearer, let us institute a simple comparison. Jupiter is larger than all the other planets and satellites of the solar system. The sun is a little more than 1,000 times larger than Jupiter. But Arcturus, if our inference is correct, is 550,000 times larger than the sun. By the side of such a majestic orb, our sun, grand and overwhelming as he is in our *own* system, would dwindle to an insignificant star.

Contemplating a world so vast, endowed with such mighty energies, and rushing with such resistless force through the great deeps of space, we cannot resist the questions: Whence came this blazing world? Whither is it bound? What is its mission and destiny? Is it simply a visitor to our sidereal galaxy, rushing furiously through it like a comet? Is it being constantly fed and enlarged by the worlds it encounters and the meteoric matter it gathers up in its wonderful journey? What would be the effect if it chanced to pass through a nebula or a star cluster? Was the new star which suddenly blazed forth in the nebula of Andromeda in 1876 due to a similar cause?

As this mighty aggregation of attractive energies sweeps along his celestial path, thickly bordered with stellar worlds, how many of those worlds will yield forever to his disturbing forces? How many will be swerved from their appointed courses by his irresistible power? How many will plunge into his fiery bosom and be swallowed up as a pebble is swallowed by the ocean?

Are there many great suns like Arcturus, flying on their special missions through space? The late Dr. Croll, in his work on "Stellar Evolution," published two years ago, conjectures that the original constituent bodies of the universe were endowed *ab initio* with high velocities, and that in their swift journeys through space each eventually comes into collision with one of his fellows.

The terrific impact of two bodies moving with a velocity of tens and even hundreds of miles per second transforms the energy of motion into heat, and both worlds are shattered into fragments, melted as in a furnace, and dissipated into luminous gas. And thus a nebula is formed which fills vast regions of space and is ultimately, in the lapse of untold ages, evolved into new systems of worlds.

Sublime as is our theme—a universe of mighty worlds, wonderful as is the complexity of their motions and influences, mysterious as is that power which pervades and rules the whole, more sublime, more wonderful, more mysterious is the human mind, which, from the standpoint of this little world, a mere speck in the great domain of creation, reaches out to the utmost bounds of the universe, formulates its laws, reconstructs its past, forecasts its future, and dauntlessly grapples with the varied problems of atoms and stars, matter and force, time and space, eternity and infinity.

The New Smithsonian Astro-Physical Observatory.

We learn from Dr. S. P. Langley, secretary, that there has been established as a department of the Smithsonian Institution a Physical Observatory, which has been furnished with specially designed apparatus for the prosecution of investigations in radiant energy and other departments of telluric and astrophysics. The communication of new memoirs bearing in any way on such researches is requested, and for them it is hoped that proper return can be made in due time.

POSITION OF THE PLANETS IN JULY.

MARS

is evening star until the 30th, and then morning star. He comes to the front on the July annals, for an important epoch in his course occurs during the month. He is in conjunction with the sun on the 30th, at 2 h. 41 m. A. M., being so near the sun as to be hidden in his rays, and also at his greatest distance from the earth. He passes at that time from the eastern to the western side of the sun and commences his course as morning star, slowly increasing in size and slowly approaching the earth, until his career as morning star culminates in the long anticipated opposition of August 4, 1892. Our ruddy neighbor is then nearer than he has been for fifteen years, or than he will be again for seventeen years. Months must pass before Mars becomes visible, but his movement though slow is sure, and the time is none too long to make a study of this interesting planet, the only member of the solar family whose real surface is revealed by the telescope.

The right ascension of Mars on the 1st is 7 h. 20 m., his declination is 23° 15' north, his diameter is 3".8, and he is in the constellation Gemini.

Mars sets on the 1st at 8 h. 5 m. P. M. On the 31st he sets at 7 h. 13 m.

MERCURY

is morning star until the 7th, and then evening star. He is in superior conjunction with the sun on the 7th, at 1 h. 18 m. A. M., when the smallest member of the solar brotherhood passes from the western to the eastern side of the sun and commences to oscillate eastward from the sun, in obedience to the law that regulates the movements of the inferior or inner planets. He meets Mars on the way, and the planets are in conjunction on the 11th, at 7 h. P. M., Mercury being 41' north.

The right ascension of Mercury on the 1st is 6 h. 22 m., his declination is 24° 10' north, his diameter is 5".2, and he is in the constellation Gemini.

Mercury rises on the 1st at 4 h. 5 m. A. M. On the 31st he sets at 8 h. 13 m. P. M.

JUPITER

is morning star. He is by far the most distinguished member of the brotherhood on the July list. He passes no important epochs in his course, and he has no meetings or partings with other planets on the celestial road. He is simply a superb star, increasing in size, and rising earlier every evening, at 10 o'clock on the middle of the month and at 9 o'clock when the month closes. Observers who command a view of the southeast horizon should watch for the appearance of this regal planet, as he looms suddenly above the horizon, like a young moon, and shines the brightest of the radiant throng that cluster in the nightly sky.

The moon is in conjunction with Jupiter three days after the full on the 24th, at 2 h. P. M., being 3° 56' south.

The right ascension of Jupiter on the 1st is 23 h. 18 m., his declination is 5° 53' south, his diameter is 41".6, and he is in the constellation Aquarius.

Jupiter rises on the 1st at 10 h. 54 m. P. M. On the 31st he rises at 8 h. 55 m. P. M.

VENUS

is morning star. The movements and position of Venus are in striking contrast with those of Jupiter. She is approaching and he is receding from the sun. She is nearly at her greatest, and he is nearly at his least distance from the earth. She is nearly at the minimum of her size and brilliancy, while he is approaching the culmination of his radiant career. Venus will be greatly missed in the summer evening sky.

The moon makes a close conjunction with Venus on the 4th, the day before her change, at 6 h. 2 m. A. M., being 2° 7' north.

The right ascension of Venus on the 1st is 5 h. 14 m., her declination is 22° 20' north, her diameter is 11".0, and she is in the constellation Taurus.

Venus rises on the 1st at 3 h. 4 m. A. M. On the 31st she rises at 3 h. 49 m. A. M.

SATURN

is evening star. He is on the meridian on the 1st at 4 h. 20 m. P. M., so that he is well advanced on his western way when it is dark enough for him to be visible. He retains his position in regard to Jupiter, being nearly opposite to him, one planet setting as the other rises. The difference is seven minutes on the first of the month, and there is no difference on the last day of the month.

The moon is in conjunction with Saturn when five days old, on the 10th, at 4 h. 31 m. P. M., being 3° 25' north.

The right ascension of Saturn on the 1st is 10 h. 58 m., his declination is 8° 44' north, his diameter is 15".8, and he is in the constellation Leo.

Saturn sets on the 1st at 10 h. 47 m. P. M. On the 31st he sets at 8 h. 55 m. P. M.

URANUS

is evening star. He is in quadrature with the sun on the 20th, at 5 h. A. M., being 90° east.

The right ascension of Uranus on the 1st is 13 h. 42 m., his declination is 10° 1' south, his diameter is 3".6, and he is in the constellation Virgo.

Uranus sets on the 1st at 0 h. 25 m. A. M. On the 31st he sets at 10 h. 28 m. P. M.

NEPTUNE

is morning star. His right ascension on the 1st is 4 h. 25 m., his declination is 20° 4' north, his diameter is 2".6, and he is in the constellation Taurus.

Neptune rises on the 1st at 2 h. 26 m. A. M. On the 31st he rises at 0 h. 31 m. A. M.

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

THE POISONOUS SNAKE OF FLORIDA.

A workman at Oakland, Orange Co., Florida, recently died from the effects of a bite received from a supposed harmless snake. The man had captured a small snake and handled it for ten or fifteen minutes, during which time he received a bite on one hand, giving him no pain at the time. Finally killing the snake, the man returned to his work.

About half an hour later pains came on in his hand and arm, followed by drowsiness and a dull pain in the head. The man quit work, saying he would lie down, and probably be at work again in a short time. He continued to feel drowsy, and a fullness of the eyelids, with a partial loss of control of muscular action of the same, was noticed.

At this point a doctor was called, who did all he could to counteract the effects of the poison, but his every effort proved unsuccessful, and the unfortunate man finally died eighteen hours after receiving the bite.

The snake was called a harmless garter or king snake. It was small and its body was circled with bright-colored bands. But an examination of its mouth disclosed two small fangs in the upper jaw. Our informant says: "Thus it seems this bright-colored, sluggish, meek little snake that we have regarded as harmless as a tadpole is one of the most dangerous of our reptile foes."

From the description received, and a residence of over twelve years in Florida, during which time I devoted much attention to herpetology, I can state positively that the snake in question was the coral snake, *Elaps distans*, also called the "Florida harlequin snake."

Its habitat is the Gulf States and Mexico. It is different from all other North American poisonous snakes in that it has not a well-defined neck, and that its tail tapers to a fine point. All other poisonous snakes in this country have large angular heads and blunt tails. The coral snake also lacks the "poison pit" of the rattlesnake, moccasin, and copperhead—a small orifice about midway between the eye and nostril on either side. This "pit" is connected with the poison sac, but its use has never been satisfactorily explained. As in the case of the coral snake, all poisonous snakes do not have the "pit," but every snake possessing it is armed with deadly fangs.

The color of the coral snake is varied with bright bands of black, white or yellowish white, and coppery red. It is rarely over eighteen inches in length (usually much less), and one-half or three-fourths of an inch in diameter. It is not common in Florida or the Gulf States.

There is another quite common snake in Florida which very closely resembles the coral snake, both in color and size. It is marked with brilliant bands of red, yellow, and black. It is called a garter snake, band snake, etc., by the natives, and by some it is thought to be poisonous. It is entirely harmless, however, and without fangs, as repeated examinations by myself and others clearly proved.

S. Weir Mitchell, in an article on "The Poison of Serpents," appearing in the *Century Magazine* of August, 1889, incidentally refers to the coral snake as "the beautiful coral snake, the little *Elaps* of Florida, too small with us to be dangerous to man."

That it *is* dangerous, under certain circumstances, the above instance—one of two or three cases known in which the coral snake of the United States has destroyed human life— proves beyond dispute. Owing to its scarcity, however, it is seldom met with, and its small size prevents it from inflicting a wound after the usual manner, but if one exposes bare feet and ankles or hands within striking distance, especially after irritating it, a hypodermatic injection of its venom is quite apt to be received, and is as much to be dreaded as a bite from the rattlesnake. CHARLES H. COE.

Banana Flour.

Referring to an article in the SCIENTIFIC AMERICAN of June 6, a correspondent says: The flour is made from green bananas—not ripe ones. They are peeled, sliced, and sundried, afterward pounded in a mortar and passed through a coarse sieve.

To preserve the ripe bananas they are dipped in lye and dried in the sun, shriveling up under this operation, and tasting somewhat like figs. The color of the banana flour is dirty gray, like ashes.

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