Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, DECEMBER 1, 1894.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 987.

For the Week Ending December 1, 1894.

Price 10 cents. For sale by all newsdealers.

THE HEAVENS IN DECEMBER.

During the evenings of December the great winter constellations enter fully upon the scene, the incomparable Orion occupying the central place in the celestial spectacle like some gorgeous Eastern potentate surrounded by his vassals. It is impossible for any person of average intelligence to look upon these starry hosts, splendid as an army with banners, and not feel that there is a deep significance in the display. When all the sky is glittering with the light of distant suns, of every conceivable stellar magnitude, and many of which exhibit surprising contrasts of color, no beholder can resist the conviction thus forced upon his mind that our sun no more stands for everything that a sun may be than a rose represents all the splendor of color and all the grace and beauty of form that can exist in a garden filled with every variety of flowers. Fortunately for those who have eyes to see, these wonders of the heavens are not merely to be read about, like the departed glories of the Caliphs of Cordova, but any one who chooses may see them for himself. And there is no better time to begin an acquaintance with the stars than in the opening month of winter. But the unlucky denizens of cities never see Orion and Taurus and the starry fields of the Galaxy as their country cousins do. Aldebaran never looks so like a flaming ruby suspended in the firmament, and Sirius never blazes with such dazzling beauty as when the dark vault they adorn rests upon hilltops sparkling with the frosted jewelry of untrodden snow.

At the beginning of December Orion is well above the horizon by 8 P. M., and at the end of the month it is half way to the meridian by that hour. The best time to see it is after 9 P. M., when Sirius, the Dog Star, has also risen, while Taurus, carrying the Pleiades and Hyades, shines above it toward the west, and Gemini, with its twin stars, follows high in the east. Northward from Orion, and near the zenith, at the same hour will be seen the brilliant white star Capella in Auriga. The Milky Way then spans the sky like a glowing arch, beginning at the eastern horizon near Sirius, passing across Auriga, Perseus, and Cassiopeia in midheaven, and disappearing in the northwest, where the Northern Cross lies athwart its course and the beautiful Vega glitters on the verge of the horizon.

Now take out your three-inch telescope and try if you can see the companion of Rigel, the bright, white star in Orion, which you find as far below the three stars of the Belt as the orange brilliant Betelgeuse is above it. It is a good test, unless your eye is trained to such work, but if the air is reasonably steady, you will see the little blue star playing hide and seek with you among the blinding white rays of its great comrade. It is a sight worth a frost bite to behold. Then turn to the Great Nebula, and when you have wondered sufficiently at that, drop your glass a little until you have caught the multiple star, Iota, in the field. (See Proctor's Atlas.) It will certainly surprise you, if you have not seen it before, and if you have, you will be delighted to see it again. Your glass may not show more than one of the two nearest companions of the largest star in the field, but you will find gems enough within sight. Orion and its neighboring constellations abound with beautiful telescopic objects, which I have not space even to mention here.

But no matter if you have no telescope; take your opera glass, and with it survey the Pleiades (splendid sight!) and the Hyades, which some people call the letter A or the letter V, and whose chief brilliant is Aldebaran. Look also with your operaglass at Orion's Belt, and sweep with it along the Milky Way, particularly that part of it which is nearly overhead. You cannot guess what a revelation lies within the power of so humble an instrument.

From the stars we turn to the planets. Mars is still in view, crossing the meridian about 8:30 P. M. at the beginning of the month and about 7:30 P. M. at the end of it. It is still possible with telescopes of moderate power to see some of the markings on the planet. During November several of the "canals" were seen to have become double.

Jupiter will gradually become a more glorious object as the month grows older. He is in opposition on the 22d. At the beginning of the month he rises at 6 o'clock in the evening and crosses the meridian about 1:30 A. M.; at the end he rises at sunset and crosses the meridian at midnight. A 3 inch telescope will reveal a wealth of details on his belted disk. Watch also for the eclipses and transits of his satellites. The shadow of a satellite during transit is like a minute drop of black ink on the lightly-colored face of the planet. I give two or three of the convenient dates on which these phenomena may be seen. On December 2, satellite I will be eclipsed in Jupiter's shadow at 10:50 P. M., and will reappear from behind Jupiter at 1:34 A. M. December 3. The same satellite will cross the face of Jupiter on the night of December 3, its shadow appearing a little in advance. The transit of the shadow will begin at 8:08 P. M. and that of the satellite at 8:37 P. M. The shadow will pass off at 10:24 P. M., and the satellite at 10:53 P. M. On the 10th, satellite I will again transit Jupiter, the shadow appearing at 10:02 P. M., and moving off at 12:19 A. M., December 11. As before, the satellite will follow just behind the shadow. On the 15th satellite II will transit the planet, the times of the beginning and end of the crossing for the shadow being 9:05 P. M. and 11:42 P. M. respectively, and for the satellite 9:27 P. M. and 12:03 A. M., December 16. This is all in Eastern standard time; deduct one hour for central time.

The month opens with a crescent moon. The moon reaches first quarter on the 5th at 7:15 A. M., fulls on the 12th at 2:45 P. M., and attains last quarter on the 19th at 6:15 A.M. The new moon of the month occurs on the 26th at 9:20 P. M. The moon will be in apogee early in the afternoon of the 2d, and about 6 o'clock in the morning on the 30th, and in perigee a little before 9 o'clock on the morning of the 14th. The moon will be close to Mars on the evening of the 8th, and to Jupiter on the morning of the 13th.

The sun enters Capricorn, and the astronomical winter begins on the 21st at 9 minutes after 3 o'clock in the afternoon.

GARRETT P. SERVISS.

What a Colliery Manager Should Know.

A writer in the Science and Art of Mining, whose opinion was asked as to the subjects in addition to the three R's (reading, writing and arithmetic) that a person aspiring to hold a colliery manager's certificate should endeavor to get a thorough knowledge of, replies as follows:

The subjects, in addition to the three R's, which intending colliery managers should endeavor to get a thorough knowledge of are as follows: (1) Geology, which gives them a knowledge of the rocks forming the earth, and the formations in which coal is found; also of faults, dikes, wash-outs, etc., which interrupt the continuation of coal seams. (2) Boring and sinking, a knowledge of which is required in opening new royalties and in searching for coal seams that have been dislocated by faults, etc. (3) The practical working of mines, which enables them to lay out a mine on the most advantageous systems of working, hauling and drainage. (4) Principles of mechanics, which enables them to know the strength of beams, girders, ropes and chains required for different kinds of work; also the horse power of engines required for winding, hauling and pumping certain quantities of water. (5) Steam, compressed air and electricity. The properties of steam and the principles of the steam engine enable them to use steam economically and to the best advantage, and to superintend the erection of engines, and be a help to them in purchasing new engines. Compressed air, which enables them to know the advantage of it over steam for driving, drilling and coal-cutting machines. Electricity, so that they may know something of the advantages of electric signaling and lighting, and of the transmission of power for long distances. (6) Mine ventilation, gases, coal dust, lighting of mines, explosives and blasting. A thorough knowledge of these, if properly carried out, insures the safe working of a mine, and will considerably reduce the causes of explosions. (7) Surveying, because the manager is responsible for the plans to be produced to the inspector and for his workings trespassing into other royalties, and for leaving sufficient coal under surface erections, etc. (8) The Coal Mines Regulation Act, which should be well understood to comply with the act in all details for safety. (9) And last, but not least, he must study mankind, so as to be able to deal properly with and manage men of all shades of opinion.

Invent Something.

"One of the best opportunities for a young man to make money quickly in these days," said a self-made millionaire to a writer in the New York Tribune, "is to rack his brains until he has invented something useful or that the public wants. A general impression prevails that it takes a skilled engineer or a man of phenomenal inventive ability to develop anything useful to manufacturers in this age of machinery. But there is a wide field open to shrewd amateurs, so to speak, to supply little articles of convenience to housekeepers, shopkeepers, etc., and designers can be had at reasonable rates to execute the idea, once it is conceived. American women are so accustomed to getting what they want that anything which lightens their labors in the household is sure to go. When I was a boy on the farm at home, my mother used to make me clean all the dinner knives on Sunday with a bath brick. Now, scraping this brick into a fine powder, without lumps in it, used to be the most tedious part of the whole work. The other day I heard of a man who has made a fortune by supplying the trade with powdered bath brick in neat packages. You know how difficult it is to pick up small coins from a wooden counter. Yet the whole civilized world has growled at and endured it since coins were stamped and counters made, until the other day a young fellow invented a rubber mat with little bristles of rubber standing up thickly all over it. Coins thrown on the mat are as easily picked up as if they stood on edge. The public was quick to appreciate it, and the inventor need not work for a living any longer."

The Antiquity of Iron and Steel.

BY G. D. HISCOX, M.E.

The use of iron and steel in the early ages of the human race has been a much mooted subject in past years.

The means of quarrying and dressing the hard granitic stones of the pyramids, obelisks, giant statues, vast temples of Egypt and the rock-cut temples of India have been matter of mystery only because the proper tools for this work have disappeared from the remains of ancient appliances.

To satisfy modern ideas as to the nature of this mystery an ideal resort to some substitute for iron and steel has been made in a mythical bronze, the manufacture of which has been assumed as a lost art.

An alloy of the only metals known to the ancients that produce a hardness suitable for cutting tools is as well known to-day as in the early ages; but no such alloys are suitable for cutting granite or sienite, although marble, slate, and sandstone readily yield to their cutting pressure.

The finding almost exclusively of metallic tools and instruments, relics of a reputed bronze age, does not conflict with the probability of a contemporaneous use of iron and steel, for the resisting properties of bronze to oxidation by exposure to the damp atmosphere where such relics are usually found is vastly greater than with iron and steel; yet the few samples named as iron (possibly steel) that have been found in protected situations are facts of value.

The British Museum contains the Layard collection found at Nineveh of Assyrian armor plates, shields, battle axes, saws, and other objects of iron or steel of a date probably 1,000 or more years before the Christian era; and as history goes, the prints of various articles of oxidized iron were there uncovered, to fall to pieces by handling, that would have remained intact if undisturbed for countless ages.

If those cutting instruments had been made of steel, no trace of the fact would be left in their oxidized remains, for the steel constituting element would naturally disappear in the oxidizing process.

The Chalybians, a Scythian race, were makers of steel 500 years B. C., and their name was given to the finest steel by the Greeks.

India has been celebrated from the earliest times for the quality of its steel; its Wootz is referred to as of the highest grade, and to it, or the Chalybian steel, may have been due the renown of the Damascus blades.

The iron column at Delhi, a forging not to be sneered at from the standpoint of our largest modern forged shafts, was bloomed, welded, and chipped into a symmetrical form with a complex fluted capital, that nothing but steel chisels and hammers equal to our modern tools could have been used to mould into such artistic form. It is a marvel of antiquity; 60 feet in height, about 16 inches diameter at base, tapering to 12 inches at the top, with an enlarged capital with ornamental fluting. Its estimated weight is 17 tons. It dates from an age about 900 years before the Christian era, thus showing an advanced state of the art of iron working almost prehistoric; for a work of that magnitude could not possibly be produced at that age of human civilization and art without ages of previous apprenticeship. It stands alone above all other relics, a monument commemorative of the state of the mechanic arts in prehistoric times, only paralleled by the discovery of iron and steel tools in the tumuli in India of a supposed date some 1,500 years before the Christian era.

China also claims a great antiquity in the process of making iron and steel; the Chinese record minutely describing the processes is still preserved and is accredited as from a very early age by archæologists.

The mariner's compass dates back to 1100 B. C. in Chinese history. We cannot conceive of anything but hardened steel suitable for the compass needle.

Coming back to the supposed centers of ancient civilization, Tubal Cain was an "instructor of every artificer in brass and iron," which was also well known in the times of Moses, 1,500 years B. C.

The iron wedge found in the Great Pyramid and the sword blade found by Belzoni under the Sphinx at Karnak carries the date back 3,500 years B. C., and possibly to 4,400 years, to the times of Menes.

Job mentions a pen used to engrave upon rocks and a bow of steel, while Homer alludes to the tempering of steel by the plunging of the hissing ax into cold water.

The reputed iron wedge found under the obelisk now in Central Park was probably a semi-steel, as it was found to contain by analysis over a half per cent of carbon and smaller portions of other constituents as usually found in blister steel; which indicates a probability of a practice in those early times of conversion of iron into steel by cementation.

The inhabitants of Great Britain were manufacturers of iron before the landing of the Romans, who fostered the art there and worked bloomeries and Catalan forges before and during the first century.

It has been suggested that corundum set in bronze chisels was the material that worked the chiseled surfaces of the huge blocks of sienite and basalt of the Egyptian temples and their intagliated inscriptions; but when we consider its brittle nature, and how small a blow will split and crush the crystals, the suggestion becomes but an idle thought.

There is no doubt that iron and copper saws and tubular drills were in use with pulverized corundum or emery as an abrading material for sawing and drilling the hardest granite. On this the evidence is very conclusive from the observed saw and drill marks and the simplicity of the operation.

The use of laps for grinding and polishing tablets, cylinders, signets and precious stones, and the methods of engraving their inscriptions by revolving tools charged with corundum or emery, is too well attested by a close inspection of the numerous and beautiful examples in our Metropolitan Museum and in possession of collectors of these most antique relics of an almost prehistoric civilization.

Emery and corundum were well known to the ancients, being found in large quantity in the islands of the Grecian Archipelago, in the vicinity of Smyrna and ancient Ephesus in Asia Minor. The repute of the lapidists of Magnesia, Ephesus, Tralles and Tyre were of note early in the pre-Christian age.

The commerce of Egypt extended over all these regions and far to the east, and it is reasonable without a doubt that not only the art of cutting, sawing and drilling with emery was accessible to the Egyptians in the earliest times, but that the use of hardened steel tools should not also have spread to Egypt as a commercial commodity, if the ore and its manufacture into iron did not exist there.

It is well authenticated that among all the bronzes yet found, there is not a single instance mentioned of a hard bronze cutting tool. Nearly all are of the ordinary alloys of copper and tin, and but few that even approach to a proper hardness for cutting any hard substance.

Thus through the long ages that the mechanic arts are known to have flourished, with an occasional cloud obscuring or retrograding their progress, they seem to have had their periods of brightness coincident with the shining eras of early civilization at various points and at various times; and which may be noted in the culmination periods of successive and dominant nationalities.

China, India, Persia, Babylon, Nineveh, Assyria, Egypt, Palestine, Tyre, Greece, Byzantium, Carthage, and at last the Roman empire completed the cycle of the arts of ancient time, and marked the beginning of the second age of the world's civilization with its grand evolution of the modern era of the arts and sciences.

Phosphorescence at Low Temperatures.

Investigations have been undertaken by Raoul Pictet, the intention being to determine the specific action of a considerable lowering of temperature upon the brilliancy of certain bodies which shine in the dark after having been exposed to sunlight. Tubes of glass filled with the powdered sulphides of calcium, barium, strontium, etc., all substances which possess the property of phosphorescence in a high degree, were exposed to the solar rays and afterward proved to be luminous in the dark. This was done in such a way as to fix upon the memory the mean value of the progressive diminution of the emitted light, and the time also was noted during which the light was strong, less strong, and weak respectively. The tubes were next placed in bright sunlight for one minute and then suddenly introduced into a double walled glass cylinder, the interspace of which was filled with nitrous oxide at —140° C. In about five or six minutes the temperature of the tubes was about —100°. They were then withdrawn and, when observed in a perfectly dark chamber, no luminosity whatever was perceptible. As the tubes recovered their normal temperature, however, the phosphorescence returned, without the exciting agency of either the sun's rays or diffused light. These results were proved to be general for all phosphorescent substances employed. The complete suppression of phosphorescence at very low temperatures having been thus demonstrated, attempts were next made to fix the limits of temperature at which the luminosity ceases to be visible. Tubes of phophorescent powder were exposed to sunlight, then rapidly conveyed to the dark chamber and partially immersed in alcohol cooled to —75°. The phosphorescence disappeared completely from the portion of the powder contained in the part of the tube immersed, when its temperature was reduced to —60° or —70°, but after immersion for more than half an hour the light returned spontaneously as the effects of cooling wore off. The phenomena were alike with all the phosphorescent substances examined. The blue, green, or orange light emitted by different metallic sulphides tended in all cases to change to an earthy yellow before being extinguished. It was proved by repeated experiments that condensed moisture on the outside of the tubes did not in any way influence the extinction of the phosphorescent light, or affect any of the observed results. It appears certain, to Pictet, that the production of phosphorescent light requires a certain movement of the constituent molecules of bodies. When these are frozen and the calorific oscillatory movements are checked, the luminous waves are not produced and the phosphorescence disappears accordingly.—Compt. Rend.

The First American Patent.

The first patent granted in the New World, so far as we have information, was that issued by the General Court of Massachusetts, to Joseph Jenkes, March 6, 1646, for an engine for mills, to go by water. In other words, it was a water engine. The patent was granted for fourteen years. The following is a copy of the patent:

JENKES MONOPOLYE.

At a generall Courte at Boston
the 6th of the 8th mo 1646

The Cort considringe ye necessity of raising such manifactures of engins of mils to go by water for speedy dispatch of much work wth few hands, & being sufficiently informed of ye ability of ye petitionr to pforme such workes grant his petition (yt no othr pson shall set up, or use any such new invention, or trade for fourteen yeares wthout ye licence of him ye said Joseph Jenkes) so farr as concernes any such new invention, & so as it shalbe alwayes in ye powr of this Corte to restrain ye exportation of such manifactures, & ye prizes of them to moderation if occasion so require.

Joseph Jenkes, of Hounslow, County Middlesex, England, settled at Lynn, Mass., in 1643, where he died in 1683, aged 81 years.

"A man of great genius." He made the dies for coining the first money; also built the first fire engine in America.

His son Joseph was governor's assistant of Rhode Island in 1681, and built a large iron foundry near Providence.

His grandson Joseph was governor of Rhode Island, 1727–1732.

The Portrait of a Public Man is Public Property.

In the United States Circuit Court, Boston, Judge Coit presiding, a suit was brought by the widow and children of George H. Corliss, the inventor and builder of the Corliss engine, to enjoin the defendants from publishing and selling a biographical sketch of Mr. Corliss and from printing and selling his picture in connection therewith. The bill did not allege that the publication contained anything scandalous, libelous, or false, or that it affected any right of property, but the relief prayed for was put on the novel ground that the publication is an injury to the feelings of the plaintiffs and against their express prohibition.

In August, 1893, Judge Coit decided that the plaintiffs had no right to an injunction preventing the publication of the biographical sketch, and the present decision is on the photograph alone. The court now says, in part:

While the right of a private individual to prohibit the reproduction of his picture or photograph should be recognized and enforced, this right may be surrendered or dedicated to the public by the act of the individual, just the same as a private manuscript, book or painting becomes (when not protected by copyright) public property by the act of publication. The distinction in the case of a picture or photograph lies, it seems to me, between public and private characters. A private individual should be protected against the publication of any portraiture of himself, but where an individual becomes a public character the case is different. A statesman, author, artist, or inventor who asks for and desires public recognition may be said to have surrendered this right to the public. When any one obtains a picture or photograph of such a person, and there is no breach of contract or violation of confidence in the method by which it was obtained, he has a right to reproduce it, whether in a newspaper, magazine, or book. It would be extending this right of protection too far to say that the general public can be prohibited from knowing the personal appearance of great public characters. Such characters may be said of their own volition to have dedicated to the public the right of any fair portraiture of themselves. In this sense I cannot but regard Mr. Corliss as a public man.

Submarine Torpedo.

Mr. Seymour Allan, a resident of Sydney, has invented a submarine torpedo boat, which, he claims, is capable of sinking to any depth, and of traveling rapidly under water without revealing its presence. A working model of the boat was tried on October 30 in the public baths at Sydney, in the presence of the Earl of Hopetoun, the governor, the naval commandant, and a number of naval and military officers. The experiments were a complete success, the model rising, sinking, turning, reversing, or remaining stationary in obedience to the electric current by which it is worked. The inventor claims that a full-sized boat would be capable of remaining under water for three days. It would carry torpedoes on the bow and stern decks.