

GEORGE H. CORLISS.

George H. Corliss, the inventor of the improvements in the steam engine that bears his name, and has won for him an enviable fame the wide world around, was born in Easton, N. Y., on June 2, 1817. His father, a physician, removed to Greenwich, N. Y., in 1825, and the son attended school there until he was fourteen years of age.

He then found employment in a store connected with a cotton factory, as general clerk, remaining in this position for several years. His desire for a liberal education and his thirst for knowledge became so earnest and engrossing that he resigned his situation and entered an academy at Castleton, Vt., where he faithfully pursued his studies for three years.

His academic days being completed, his next move was to establish a country store in Greenwich. The venture was more than successful, but young Corliss, weary of the monotony and limited sphere of his business, developed aspirations for a wider field of labor. During the later years of his residence in Greenwich, there were intimations of the inventive genius and mechanical tastes that were to be the distinguishing features of his brilliant career. He was eighteen years old before he had ever seen the inside of a machine shop.

The hour came, however, for action in the field for which he was especially adapted, and he was not found wanting. Greenwich is divided into two sections by the Battenkill, and the only bridge that united the two parts of the town was carried away by a spring freshet. The result was a serious inconvenience to the town. The prominent citizens decided, at a meeting held for the purpose, that a temporary bridge was impracticable, and adopted a plan for building a scow to ferry passengers and teams over the stream. Young Corliss, in spite of strong opposition, devised a plan for a bridge, raised \$55, the necessary funds, by subscription, and, with the help of volunteer farmers and workmen, completed a bridge in ten days that did excellent service for six months.

Another occurrence showed more plainly the special field of Mr. Corliss' inventive power. Boots and shoes were a prominent item of merchandise in his country store. He became impressed with the idea that machinery might be properly used in their manufacture. The result was the construction of a machine for stitching leather; this invention antedated that of the Howe sewing machine. While improving and developing this machine, he commenced the manufacture of the tools required in its construction, and he was thus introduced into the machine shop, and the steam engine business was the result.

An important epoch in Mr. Corliss' life occurred in 1844. He removed to Providence, R. I., and became identified with, and finally the head of, the firm of Corliss, Nightingale & Co., and in 1848 he completed and started a steam engine, embodying the essential features of the improvement he had designed. In the Corliss engine the governor is connected with the cut-off, instead of the throttle valve. The governor does no work, but simply indicates to the valves the work to be done, thus by one feat of engineering skill obtaining two results—uniformity of motion and economy of fuel. The improvement was so great and so practical that the Corliss engine has obtained a unique position of its own.

The Corliss Steam Engine Company was incorporated in 1856, with Mr. Corliss for president. He was his own architect and engineer in designing and constructing the buildings for the factory. The grounds extend over more than nine acres, the buildings covering half the space, and the rest being devoted to lawns, drives, and ornamental shade trees.

In 1872, Mr. Corliss was appointed commissioner for Rhode Island to the international exposition at Philadelphia, and was chosen as one of the executive committee of seven, to whom the preliminary work was intrusted. In 1875, he submitted plans for the construction of a grand central steam engine of 1,400 horse power, proposing not only to utilize it as the motive power for all the machinery to be exhibited, but also to make it an ornament to this department of the exposition. After much delay and vexatious opposition, the plan was adopted. Every visitor to the Centennial bore witness to the success of the experiment in the perfect adaptation to the requirements demanded, and also to the artistic elegance of its construction. The result was produced by the untiring energy and determination as well as the engineering skill of Mr. Corliss in devoting his personal attention to the construction of the engine, and also to the fact that he contributed \$100,000 to the work from his own private funds over and above the aid furnished by the commission. Many wonderful and beautiful sights and scenes at the exposition will be forgotten, but long as life en-

dures will memory bring back the thrilling moment when the Corliss Centennial engine, like a being endowed with life and touched by a magic wand, commenced its movement for the day, and did its work with an almost human intelligence.

Mr. Corliss gave his busy brain no rest. Some of his later inventions are a machine for cutting the cogs of bevel wheels, an improved boiler with condensing apparatus for marine engines and pumping engines for water works.

The last three years of Mr. Corliss' life were occupied with the invention and construction of special machinery to be used in the manufacture of steam engines, with the firm conviction that he would thus be enabled to lessen the cost to the purchaser. In this plan several of the mechanical operations on each piece of machinery are carried on and completed with one adjustment and one set of tools. In order to make the plan successful, a number of pieces of the same shape must be manufactured. The inventor's purpose was to extend his business sufficiently to be able to keep special machines busy all the time on every detail, and to accomplish this aim he perfected an organization by which three large engines can be turned out every ten hours, complete in all their intricate parts.

His plans were at length completed to his entire satisfaction, the reorganization of his working force was adapted to the new methods of handling material from the time it entered the works until it was finished, and the special tools were ready to commence their task at the master's call. But he was not destined to behold



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the active operation of his latest invention—the triumph of his art. In the midst of his honorable career, in his golden prime, he passed away on February 21, 1888, in his 71st year, having lived a little beyond the threescore and ten years allotted to man.

Mr. Corliss received many proofs of the high appreciation in which his important inventions were held. He won the highest competitive prize at the Paris Exposition of 1867. The Rumford medals were awarded to him in 1870 by the American Academy of Arts and Sciences. He received the Grand Diploma of Honor from the Vienna Exposition of 1873, although not an exhibitor. In 1878 the Institute of France gave him the Montyon prize, the highest honor for mechanical achievement. In 1886 the King of Belgium made him an officer of the Order of Leopold.

On the other hand, he had the usual experience of inventors. Obstacles beset his path. There were conflicting interests, competition, deeply rooted prejudices to overcome; vexatious lawsuits were forced upon him, continuing for fifteen years, and costing him \$100,000, but ending in a full vindication of his claims.

Strength and tenderness were the distinguishing features of Mr. Corliss' character. The strength was apparent to all, the tenderness found its fullest expression in domestic life. He sought with conscientious purpose to find out what was right, and, when his mind was made up, held to the courage of his convictions, swerving neither to the right nor left. As a matter of principle, he threatened to stop the running of the Centennial engine, if the exposition were open on Sunday, and he carried his point. He refused to countenance corruption and bribery in accomplishing his purposes. He made large contracts to build engines for the government during the civil war, and waited seven years for his pay, with a heavy loss of interest, rather than condescend to give retainers for the influence of Washington lobbyists.

The sunny side of Mr. Corliss' character found its highest expression in his home, the beautiful home in whose structure, convenience, and ornamentation every resource of his inventive genius found expression. Here, in the society of his wife and daughter, he passed his happiest hours. This man of strong will and stately mien was tender, chivalrous, loving, and beloved.

Mr. Corliss spared neither pains nor expense in carrying out his plans, cost scarcely entered into the calculation, if it insured success. He also contributed generously to religious and charitable institutions.

Mr. Corliss was of a modest and retiring nature, and rather avoided than sought after the public prominence he might have attained. He was, however, in the State Senate in 1868–70, and was a presidential elector in 1876. He refused the nomination of mayor and governor.

In a handsome tribute to his memory, the *London Engineering* says as follows: "By the death of George Henry Corliss, America has lost the best known engineer she has ever produced. In all the countries of the world where steam engines are employed the name of Corliss has been heard, and ranks next in familiarity to that of Watt. Indeed, it has become so much a part of our technical vocabulary that many engineers will learn with surprise that little more than a month ago the owner of it was not only alive, but was the active head of the Corliss Steam Engine Company, of Providence, R. I. Many men verging on middle age found the Corliss engine an established fact when they entered on their apprenticeship, and hence they have been disposed to class its invention with the events of ancient history, and its inventor with those who are either dead or superannuated. There could, however, be no greater mistake. Mr. Corliss has, it is true, passed away full of years and honors, but he was busy up to the last week of his life with a new Pawtucket pumping engine, and with the reorganization of the factory with which he was connected."

Fabulous Astronomy.

The stars have always had a great influence upon the imagination; so the progress of astronomy through the ages gives us a faithful image of the conquests of the human mind. We propose now to study the beginnings of astronomy, which are, as it were, the alphabet of that science.

DIVISION OF TIME.

We have watches, clocks, and calendars in profusion; but our primitive ancestors had nothing that permitted them to measure time—nothing at least but the sun and moon, which still serve our rustics to some extent, but so slightly that the bell is called upon to make known the principal divisions of the day to laborers in the fields. The course of the sun gave the succession of the days, and the lunations indicated the months. As for the seasons, at the renewal of the year, there was at first no rule that permitted of forming a calendar. Primitive man was therefore his own astronomer, and

the various systems proposed in ancient times vividly reflected the temperament of their authors.

The darkness of night exerted a sort of terror on the mind of our ancestors. Just as material existence succeeds nothingness (which it is also followed by), just so does day succeed night, which is the origin of time, as winter is that of the year. The Ostiaks of the Yenisei reckon their years by snows, and the Iroquois of North America by winters. The Numidians, the Gauls of Cæsar, and the Germans of Tacitus reckoned the diurnal periods by nights. In the north principally, night had considerable importance, and the Scandinavians possessed the best connected and most poetical ideas. Day was the son of Nott, "night." The latter proceeds first, says a passage of the Edda, mounted upon his horse Rinfoxe, "ice mane." Every morning, on finishing his career, the courser sprinkles the earth with the drops of foam that fall from his bridle, and that is dew. Day follows, mounted upon Sinfoxe, "luminous mane," and his mane illuminates the air and earth. These peoples believed also that the longest night, that of the winter solstice, was the progenitor of all the others, and that the world was created during such a night. That is why it was called the "mother night." It was the greatest holiday of the year, and, at the same time, the origin of the new year. It was styled also Juul,* the present name of Christmas, which has replaced it.

The Chaldeans said that the world began at the autumnal equinox, when the night became longer than the day.

In the seventeenth century, the French tribunals were still giving orders to "put in an appearance within fourteen nights." The English say "fortnight," an abbreviation of "fourteen nights," to designate the two weeks' interval which is improperly called in French *quinze jours*.

* English, Yule.

CURIOUS IDEAS ABOUT THE MOON.

The phases of the moon have been much remarked, and the cycle of these various appearances is short enough to favor that convenient division of time which was the ancient month, and which still serves the Israelites and Mussulmans for their calendar. When the Indians of several tribes united for some enterprise, the signal for the rendezvous was usually a full moon designated a long time in advance.

The beautiful moonlight of countries that have a usually pure atmosphere offered an invitation to games and festivities. The new moon interrupted the merry-makings, which were resumed with greater spirit when the thin silver crescent was observed after sunset. The ancient Peruvians said that the moon was dead during the three days of its invisibility. The Khasias of the northwest of India think that the sun burns it up. Several savage peoples believe that they see in the lunation a quarrel between the sun and the moon (which to them are husband and wife), passing monthly through the same phases. The moon grows from new moon to the full, then wanes; the same is the case with its domination; finally, the sun triumphs and swallows its adversary, whose head it spits into the heavens. The ancient Slavonians believed that the moon, having been untrue to her husband, with the beautiful Venus, was condemned to wander in the heavens. The Dakota Indians think that the moon at its waning is eaten by little mice. The Polynesians believe that it is devoured by the spirits of the dead. The Hottentots say that it wanes when, suffering from a headache, it puts its hand to its forehead and hides the latter from our view. The Eskimos imagine that the moon, harassed by fatigue and hunger after finishing its journey, retires for a moment to take rest and food. Its apparent corpulence after its reappearance shows with what avidity it has fed.

The spots on the moon have attracted attention and stirred the imagination in all ages. There is probably no country in which an imaginary picture has not been seen in the disk of our satellite; and yet, among the various figures that are thought to be seen in the moon, two principal types seem to prevail, according to a certain geographical distribution. In Eastern Asia, the common vision is that of a hare or rabbit. The Chinese imagine that they see a rabbit seated upon its haunches before a mortar and pounding rice, after the manner of the country. The Hindoos see a hare or a squirrel, and they call the moon the hare or squirrel carrier. The Siamese see the figure of a hare in the moon; although some distinguish therein a man and woman cultivating their field.

[Albertus Magnus thought that the form of the spots represented a lion with his tail toward the east and his head to the west; others have thought it to be much more like a fox.]

Among many of the Indian tribes of North America, the hare is the symbol of the moon, as the jaguar is that of the sun. The Mexicans maintained that there was a rabbit in the moon's disk, and this was connected with one of their myths. In Central America, the moon is figured upon certain structures as a pitcher, or as a spiral shell whence a hare is emerging.

[According to Iroquois tradition, an old woman gifted with the power of divination was unhappy because she could not also foretell when the world would come to an end. For this, she was transported to the moon, where to this day she is seen weaving a forehead strap. As once a month she stirs a kettle of hominy, an ever-present cat unravels her net, so her work will never be finished.]

When we pass from North to South America, the image placed by popular belief on the globe of our satellite undergoes an entire change, and the hare and rabbit give way to a human figure. The Incas relate that a courtesan, promenading on a moonlight night, was taken with the beauty of the star, and, wishing to own it, rushed toward it in order to embrace it. The moon clasped her with a vigorous movement, and still holds her.

In the Samoan Archipelago they distinguish a woman and her child, who have been transported to the moon. On the Book Islands, men are seen in the moon, and at Timor, an old woman spinning. The principal African nations, especially those of the south, distinguish a human face.

The ancient Scandinavians connected the spots on the moon with a legend: "Mane," says the Edda, "regulates the course of the moon and its different quarters. One day he carried off two children, Bil and Hiuke, as they were coming from a fountain carrying a pitcher suspended from a stick. These two children have not left the moon, as every one may see."

[To the poets, the spots represent the boy Endymion, whom Diana loves so well that she carries him with her.]

In the explanation of the Eskimos of Greenland, Anninga, the moon, brother of the beautiful Malina, the sun, was one day chasing his sister, and was about reaching her, when she turned, and, with her fingers all black from the soot of a lamp, besmeared the face and clothes of Anninga, who has always carried the marks thereof.

The Khasias, who think that the moon is burned every month by the sun, see in the spots on its disk the ashes resulting from such combustion.

[The Jews have some Talmudical story that Jacob is in the moon, and they believe that his face is visible.]

The Greek vision of a maiden's face has been transmitted to the Latin nations. Peoples of German origin incline more to the image of a little man bent under the weight of a burden. Shakespeare speaks several times of a man near whom is observed a dog and a bush.*

In France, according to locality, the peasants think they see in the moon the figure of the traitor Judas; Judas hanging from an elder tree branch; Jean de Navets, wheeling his barrow full of stolen turnips; the fratricide Cain resting upon his spade and looking at the innocent Abel lying at his feet; † a peasant guilty of having cut wood on the domains of his lord, and snapped up by the moon; a peasant who went to fence his field in on Sunday, and who was condemned to freeze in the moon, loaded down with a fagot of thorns; a hunter and his dog; a she goat and her keeper, who is milking her near a bush, and always with the everlasting fagot.

[Another and very ancient superstition is that the lines and spots on the moon's disk are the figure of a man leaning on a fork, on which he carries a bundle of thorns or brushwood, for stealing which, on a Sunday, he was confined in the moon—a belief probably based on the account given in Numbers xv. 32 of a man who was stoned to death for gathering sticks upon the Sabbath.]

It is unnecessary to say that with a good telescope we perceive simply luminous and dark areas, and detect mountainous regions and craters of extinct volcanoes. Some astronomers find a great resemblance to the tail of a peacock, or to the appearance exhibited by powdered plaster, irregularly arranged and thoroughly wet, upon which the sunlight is falling.

During eclipses of the moon, men of ancient times experienced the greatest fear. Total eclipses of the sun are very rare. There occurs but one at the most per century, in a given place, and it lasts hardly five minutes. The partial eclipses of this star produce no more effect than an interposition of the clouds, so that such phenomena occurred without exciting attention. The same was not the case with lunar eclipses, which take place at the moment of the full moon. As our satellite is then visible all night if the heavens are clear, we easily follow the changes that occur on its disk.

When the moon was eclipsed, the Incas believed it to be sick. As soon as it began to be observed, a feeling of inquietude prevailed. If it entirely disappeared, it was the sign of certain death. It could no longer sustain the heavens, it would fall upon the earth and crush poor mortals, and the earth would end. So, as soon as one of these eclipses was seen, the dates of which were unknown, every one grabbed whatever instrument he could put his hands upon—drums, trumpets, kettles—and made a frightful noise. Dogs were tied up and whipped in order to make them howl dolefully, under the belief that the moon loves these animals, and that, touched by their groans, it would make an effort to revive. It is probably for this reason that we say of a dog barking at night that he is baying at the moon. Did the Greeks of classical antiquity speak otherwise of Diana, the huntress?

In Peru, during lunar eclipses, the men, women, and children cry in deafening unison, "*Mama quilla, mama quilla!*" i. e., "mamma moon," supplicating the celestial powers not to let them die. When the light returns, they praise the great god Pachacamac, the upholder of the universe, who has cured the moon, and, through this, has prevented it from putting an end to the existence of men.

The Huron and Carib Indians had about the same ideas. The terrible Carib demon Maboya, who is the author of frightful apparitions, sickness, thunder, and tempests, tries to devour the star of night. In order to put the monster to flight, a great racket was made by striking pieces of bark, drums, and kettles, and especially by shaking the *maracas* (gourds containing pebbles). The Caribs, young and old, men and women, then danced all night, jumping with the feet joined, one hand upon the head and the other upon the buttock, without singing, but uttering mournful and terrible cries. Those who had begun to dance were obliged to continue until daybreak, without daring to quit, no matter what the necessity. Meanwhile, a girl shook a gourd containing some pebbles, and tried to attune her coarse voice to this tiresome racket.

The Eskimos hide their provisions and close their dwellings, for fear that the sun or moon may enter. The men utter cries and strike resounding blows, and the women pull the dogs' ears. If these animals howl, the end of the world is not yet near, since they existed before man and have a much more certain presentiment of the future.

* See *Midsummer Night's Dream*, act iii., scene i., and *Tempest*, act ii., scene ii.

† This is the Italian idea, too. Dante, in the *Inferno*, describes the moon by the periphrasis, "*Castro e la spina.*"

[Whenever there is a lunar eclipse, the Odjibway Indians say *gisiss nido*, "the moon is dying."]

Some South American tribes think that, during eclipses, the moon is devoured by a gigantic dog. The Guaranis think that the animal is a jaguar, and the ichthyophagous Makahs of the strait of Fuca think it is a shark that does it. On such occasions many tribes shoot arrows into the air in order to drive away the pretended enemies of the sun and moon. This recalls an exploit of Alphonso VI., King of Portugal (1664), who, learning that a comet, the precursor of the death of a sovereign, had been observed in the heavens, ran out to look at it, and, after insulting it, shot at it with a pistol several times!

The Scandinavians had pretty much the same ideas. The moon and the sun, Mane and Sunna, which are brother and sister, are walking fast, pursued by two terrible wolves ready to devour them. The most dreaded one is Managarmr, a monster who fattens upon the substance of moribund men, and sometimes eats the moon and spills blood in the heavens and air.

Despite the relatively advanced state of astronomy among the Hindoos, this people preserves in the heavens the head and tail of a dragon that tries to devour the sun and moon during eclipses. These are the two nodes of the lunar orbit upon the ecliptic. The duration of the revolution of the line of the nodes is still called the draconic period.

We find an analogous tradition among the Hebrews. The author of the Apocalypse represents to us a draped woman in the sun who has the moon under her feet, and who wears a diadem surmounted with twelve stars. A seven-headed dragon, capable of carrying along with its tail a third of the stars of the heavens, is waiting to devour the fruit that this woman is going to put into the world.

In the popular beliefs of Sumatra and Malacca, the darkening of the star is caused by a great serpent, which encircles it in its coils. The Alfourous of Ceram believe that the moon is asleep during eclipses, and they beat a drum in order to awaken it. The Siamese still think that eclipses are caused by the malignity of a dragon that devours the sun or moon. They therefore make a great din with stoves and kettles in order to drive this pernicious animal away. The learned understand these phenomena, and know that they can be foretold and their return be calculated. The same is the case in China; but in this eminently conservative country, the very court and authorities of the empire have indefinitely perpetuated the traditions of primitive times. An eclipse of the sun was a warning to the emperor to examine his faults and make amends for them. If the phenomenon was announced by the official astronomer, news of it was given throughout the empire, and the court prepared for it by fasting and seclusion. On the day fixed, the phenomenon was everywhere awaited with anxiety. As soon as the star began to be observed, or, to use the Chinese expression, as soon as it began to be eaten, the emperor himself gave the alarm by beating "the roll of wonder" on the thunder drum. The mandarins, who had come with their bows and arrows "to assist" the eclipsed star, shot into the air uninterruptedly. The educated Chinese know that these are but forms, but the superstition still prevails among the masses, who fall on their knees at the beginning of an eclipse, strike the earth with their foreheads, and make a great noise with drums and gongs in order to deliver the star from the dragon that threatens to devour it.

The Greek and Latin authors (Plato, Pliny, Livy) tell us that a great noise was made during eclipses. The early Christians rang bells, not only during storms, but during eclipses also, in order to war against the action of malevolent spirits, and to repulse, according to the consecration of the priest, the darkness caused by phantoms (*umbra phantasmata*), a relic of the dark geuii that devour the moon.

(To be continued.)

Trained Mechanics.

It is a notable fact, and one, too, not generally known, says the *Industrial World*, that some of the "best all-around" mechanics, i. e., those who can turn their hands to all kinds of general machine work, are men who learned their business in small shops, where all sorts and all classes of work are done. An ingenious, thinking man placed in such a shop has the best possible chance to develop all the talent there is in him. The hundred and one odd jobs required to be done will cause him to devise ways and means, and "to think," and in these ways he will grow to be a man fertile in resources, dexterous in touch, and ready for nearly any kind of work which may come along. Now mark the difference: A man trained in a large shop, with its score or more of departments, learns or works through as a rule one, two, or three different departments, of course becoming an expert in the several branches; but should occasion arise for him to do some particular work of which he has but a slight knowledge, he is out of his latitude, and makes poor progress, simply because he has not done all kinds of work; while the man trained in the small shop can adapt his hand to almost anything which turns up.