A CATECHISM OF FAMILIAR THINGS;

THEIR HISTORY, AND THE EVENTS WHICH LED TO
THEIR DISCOVERY.
WITH A SHORT EXPLANATION OF SOME OF THE PRINCIPAL

NATURAL PHENOMENA.

FOR THE USE OF SCHOOLS AND FAMILIES.
Enlarged and Revised Edition.

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PREFACE.

This book, a reprint of a successful English publication, has been so enlarged as to be to all intents and purposes new. It has been carefully revised by a Reverend gentleman, who for some time filled the chair of Physics and Chemistry in one of our colleges.

Recent inventions and improvements are described in a simple, popular style, so as to be easily understood by all, and short notices are given of prominent inventors and

scientists. The paragraphs relating to doctrinal matters conform in every respect to the teachings of the Church.

A feature which will commend the book to every teacher is the definitions of difficult words and terms, following the paragraphs in which such words occur.

Technical language is avoided as much as possible, so as to enable young pupils to become familiarly acquainted with the various phenomena of nature, the leading characteristics and general history of the objects of the animal, vegetable, and mineral kingdoms, and the fundamental truths of the arts and sciences.

The illustrations are of a superior order, and a very complete Index, which will be appreciated by every teacher, supplements the book. In a word, no pains have been spared to enhance the value of the work, and render it an important auxiliary in the dissemination of useful and entertaining knowledge.

The publishers beg to acknowledge their obligations to the Sisters of Mercy, Loretto, Pa., to whose kindness they are indebted for many valuable suggestions.

In the hope that the book may be found suited to the accomplishment of its aim, it is respectfully submitted to schools and instructors of youth, who are the best judges of its merits.

CONTENTS.

A CATECHISM OF FAMILIAR THINGS.

CHAPTER I.

DEW, WATER, RAIN, SNOW, HAIL, ATMOSPHERE, WIND, LIGHTNING, THUNDER, ELECTRICITY, TWILIGHT, AND THE AURORA BOREALIS.

What is Dew?

Moisture collected from the atmosphere by the action of cold. During the day, the powerful heat of the sun causes to arise from the earth and water a moist vapor, which, after the sun sinks below the horizon, is condensed by the cold, and falls in the form of dew. Dews are more copious in the Spring and Autumn than at any other season; in warm countries than in cold ones: because of the sudden changes of temperature. Egypt abounds in dews all the summer; for the air being too hot to condense the vapors in the day-time, they never gather into clouds and form rain.

Horizon, the line which bounds the view on all sides, so that the earth and sky appear to meet. A Greek word, from the verb signifying to mark boundaries.

Temperature, degree of heat or cold.

Condense, to cause the particles of a body to approach or unite more closely.

[14]

What are its uses?

It cools and refreshes the vegetable creation, and prevents it from being destroyed by the heat of the sun. All hot countries where there is little or no rain are therefore blessed with this provision by the all-bountiful Creator, to render them luxuriant and inhabitable; and the dews which fall are so copious, that the earth is as deeply soaked with them during the night as if a heavy rain had fallen. For this reason also it is, that we so often read in the Bible of the "dew of Heaven" being promised to the Israelites as a signal favor.

Luxuriant, fertile, flourishing.

Signal, remarkable, eminent.

From what does the vapor originate?

Vapor is water, combined with a still greater quantity of caloric,—that is, an imponderable and subtile form of matter, which causes the sensation of heat; and which, driving asunder the particles of the water, renders it aëriform.

Imponderable, without sensible weight.

Subtile, thin, not dense, or compact.

Particle, a small portion of matter.

Aëriform, having the form of air.

What is Water?

The fluid which covers more than three-fifths of the surface of our globe, and which is necessary for the life and health of the animal and vegetable creation; for without water there would be neither rain nor dew, and everything would perish. It is likewise a necessary beverage for man and the inferior animals.

Beverage, drink, liquor for drinking.

In how many states do we find Water?

In four: 1st, solid, as in ice, snow, hail, &c.; 2d, fluid, as in its common form; 3d, aëriform, as in steam; and 4th, in a state of union with other matter. Its most simple state is that of ice, which is water deprived of a certain portion of its caloric: crystallization then takes place, and the water becomes solid and is called ice.

Crystallization, the process by which the parts of a solid body, sepa[15]rated by solution or fusion, are again brought into the solid form. If the process is slow, the figure assumed is regular and bounded by plane and smooth surfaces.

Solution, the diffusion of a solid through some liquid.

Fusion, melting, or rendering fluid by heat.

From what cause is the Water deprived of its caloric?

From the coldness of the atmosphere: underneath the poles of our globe it is mostly solid; there it is similar to the hardest rocks, and may be cut with a chisel, like stone or marble. This great solidity is occasioned by the low temperature of the surrounding air; and in very cold countries ice may be ground so fine as to be blown away by the wind, and will still be ice.

Poles, the extremities or ends of the axis, an imaginary line, supposed to be drawn through the centre of the earth; or when applied to the heavens, the two points directly over them.

Is ice the only instance of Water existing in a state of solidity?

No; it is found in a solid state in many minerals, as in marble, &c., and is then called *water of Crystallization*. It is essential, in many cases, to their solidity and transparency.

Essential, necessary.

Transparency, clearness, the power of transmitting light.

Does Nature decompose Water in any of her operations?

Yes: every living vegetable has the power of decomposing water, by a secret process peculiar to itself. Fish, too, and all cold-blooded amphibious animals are gifted with the same power.

Decomposing, separating a mixed body into its several parts.

Amphibious, able to live both in water and out of it.

Of what use is this power to vegetables?

The water which they decompose affords them nourishment for the support of their vital juices, and enables them, by combining the fluid gases which compose it with those of the air and the soil, to form their different products; while the superfluous gas is abundantly given out by their leaves, to refresh the spent air, and render it [16]wholesome for the animals that breathe it.

Vital, belonging to life, necessary to existence.

Superfluous, unnecessary, not wanted.

What is Rain?

The condensed aqueous vapors raised in the atmosphere by the sun and wind, converted into clouds, which fall in rain, snow, hail, or mist: their falling is occasioned by their own weight in a collision produced by contrary currents of wind, from the clouds passing into a colder part of the air, or by electricity. If the vapors are more copious, and rise a little higher, they form a mist or fog, which is visible to the eye; higher still they produce rain. Hence we may account for the changes of the weather: why a cold summer is always a wet one—a warm, a dry one.

Aqueous, watery; consisting of water.

Collision, a striking together, a clash, a meeting.

Electricity, a natural agent existing in all bodies (see page 18).

What seasons are more liable to rain than others?

The Spring and Autumn are generally the most rainy seasons, the vapors *rise* more plentifully in Spring; and in the Autumn, as the sun recedes from us and the cold increases, the vapors, which lingered above us during the summer heats, *fall* more easily.

Recede, to fall back, to retreat.

What is Snow?

Rain congealed by cold in the atmosphere, which causes it to fall to the earth in white flakes. Snow fertilizes the ground by defending the roots of plants from the intenser cold of the air and the piercing winds.

Congealed, turned by the force of cold from a fluid to a solid state; hardened.

Fertilize, to render fruitful.

Intenser, raised to a higher degree, more powerful.

What is Hail?

Drops of rain frozen in their passage through cold air. [17]Hail assumes various figures according to the degrees of heat or cold through which it passes, being sometimes round, flat, &c.

What is the Atmosphere?

The mass of aëriform fluid which encompasses the earth on all sides: it extends about fifty miles above its surface. Air is the elastic fluid of which it is composed.

Elastic, having the power of springing back, or recovering its former figure after the removal of any external pressure which has altered that figure. When the force which compresses the air is removed, it expands and resumes its former state.

What are the uses of air?

It is necessary to the well-being of man, since without it neither he nor any animal or vegetable could exist. If it were not for atmospheric air, we should be unable to converse with each other; we should know nothing of sound or smell; or of the pleasures which arise from the variegated prospects which surround us: it is to the presence of air and carbonic acid that water owes its agreeable taste. Boiling deprives it of the greater part of these, and renders it insipid.

Variegated, diversified, changed; adorned with different colors.

Insipid, tasteless.

What is Wind?

Air in motion with any degree of velocity.

What is Lightning?

The effect of electricity in the clouds. A flash of lightning is simply a stream of the electric fluid passing from the clouds to the earth, from the earth to the clouds, or from

one cloud to another. Lightning usually strikes the highest and most pointed objects, as high hills, trees, spires, masts of ships, &c.

What is Thunder?

The report which accompanies the electrical union of the clouds: or the echoes of the report between them and the earth. Thunder is caused by a sudden discharge of electrical matter [18]collected in the air, by which vibrations are produced, which give rise to the sound.

What is Electricity?

One of those agents passing through the earth and all substances, without giving any outward signs of its presence, when at rest; yet when active, often producing violent and destructive effects. It is *supposed* to be a highly elastic fluid, capable of moving through matter. Clouds owe their form and existence, probably, to it; and it passes through all substances, but more easily through metals, water, the human body, &c., which are called conductors, than through air, glass, and silk, which are called *non*-conductors. When bodies are not surrounded with non-conductors, the electricity escapes quickly into the earth.

To what part of bodies is Electricity confined?

To their surfaces, as the outside may be electric, and the inside in a state of neutrality. The heat produced by an electric shock is very powerful, but is only accompanied by light when the fluid is obstructed in its passage. The production and condensation of vapor is a great source of the atmospheric electricity.

Condensation, the act of making any body dense or compact; that is, of bringing its parts into closer union.

In what other sense is the term Electricity employed?

This term is also employed to designate that important branch of knowledge which relates to the properties shown by certain bodies when rubbed against, or otherwise brought in contact with, each other, to attract substances, and emit sparks of fire.

Designate, to point out by some particular token.

Emit, to send forth, to throw out.

CUTTING AND GATHERING ICE, ON THE HUDSON RIVER, NEW YORK.

Whence is the word derived?

From *electron*, the Greek word for amber, a yellow transparent substance, remarkable for its electrical power when rubbed: amber is of a resinous nature, and is collected from the sea-shore, or dug from the earth, in many parts of the[19] world. It is employed in the manufacture of beads and other toys, on account of its transparency; is of some use in medicine, and in the making of varnishes.

Transparent, clear, capable of being seen through.

Resinous, containing resin, a gummy vegetable juice.

Name a few substances possessing this remarkable property.

Silks of all kinds; the hair and fur of animals, paper, sulphur, and some other minerals; most of the precious stones; the paste of which false gems are made; and many other substances used by us in the common affairs of life, are susceptible of electrical excitement; among domestic animals the cat furnishes a remarkable instance. When dry and warm, the back of almost any full-grown cat (the darker its color the better) can be excited by rubbing it with the hand in the direction of the hair, a process which is accompanied with a slight snapping noise, and in the dark by flashes of pale blue light. When a piece of glass is rubbed with silk, or a stick of red sealing-wax with woollen cloth, each substance acquires the property of attracting and repelling feathers, straws, threads of cotton, and other light substances; the substances just mentioned as highly electric are, however, merely specimens. All objects, without exception, most probably are capable of being electrically excited; but some require more complicated contrivances to produce it than others.

Electric, having the properties of electricity.

Susceptible, disposed to admit easily.

Repelling, the act of driving back.

Complicated, formed by the union of several parts in one.

Is there not a machine by which we are enabled to obtain large supplies of electric power at pleasure?

Yes; the electrical machine. It is made of different forms and sizes: for common purposes those of the simplest form are the best. A common form of the machine consists of a circular plate of glass, which can be turned about a horizontal axis by means of a suitable handle. This plate turns [20]between two supports, and near its upper and lower edges are two pairs of cushions, usually made of leather, stuffed with horse-hair and coated with a mixture of zinc, tin, and mercury, called an *amalgam*. These cushions are the rubbers for producing friction, and are connected with the earth by means of a metal chain or rod. Two large hollow cylinders of brass with globular ends, each supported by two glass pillars, constitute the reservoir for receiving the electricity. They are called the *prime conductors*, and are supplied with U-shaped rods of metal, furnished with points along their sides, called *combs*, for the purpose of receiving the electricity from the glass plate, the arms of the U being held upon either side. The other ends of the conductors are connected by a rod from the middle of which projects another rod terminating in a knob, for delivering the spark.

On turning the plate, a faint snapping sound is heard, and when the room is darkened, a spark is seen to be thrown out from the knob projecting from the *prime conductors*.

Many curious and interesting experiments may be performed by means of the machine, illustrating the general properties of electricity. For instance: a person standing on an insulated bench, that is, a bench with glass legs, or having the legs resting on glass, and having one hand on the conductor, can send sparks, with the other hand, to everything and everybody about. This illustrates communication of electricity by contact. A wooden head, covered with long hairs, when placed on the conductor, illustrates electrical repulsion, by the hairs standing on end.

If the hand is held to the knob, sparks will pass from it in rapid succession, causing in the hand a sensation of pain. This is called an *electric shock*, and is caused by the electric fluid occasioning a sudden motion by the contraction of the muscles through which it passes. The force of the shock is in proportion to the power of the [21]machine.

What are the Muscles?

Bundles of thin fleshy fibres, or threads, fastened to the bones of animals, the contraction and expansion of which move the bones or perform the organic functions of life.

Organic, relating to organs or natural instruments by which some process is carried on.

Functions, employments or offices of any part of the body.

Contraction, drawing in or shortening.

Expansion, extending or spreading out.

What is Twilight?

The light from the first dawning of day to the rising of the sun; and again between its setting and the last remains of day. Without twilight, the sun's light would appear at its rising, and disappear at its setting, instantaneously; and we should experience a sudden transition from the brightest sunshine to the profoundest obscurity. The duration of twilight is different in different climates; and in the same places it varies at different periods of the year.

Instantaneously, done in an instant, in a moment's time.

Obscurity, darkness, want of light.

How is it produced?

By the sun's refraction—that is, the variation of the rays of light from their direct course, occasioned by the difference of density in the atmosphere.

Variation, change.

Density, closeness of parts, compactness.

What is the poetical name for the morning Twilight?

Aurora, the goddess of the morning, and harbinger of the rising sun: whom poets and artists represent as drawn by white horses in a rose-colored chariot, unfolding with her rosy fingers the portals of the East, pouring reviving dew upon the earth, and re-animating plants and flowers.

Harbinger, a forerunner.

Portals, gates, doors of entrance.

Reanimating, invigorating with new life.

What remarkable phenomenon is afforded to the inhabitants of the polar regions?

The Aurora Borealis, or Northern Lights, a luminous appearance in the northern parts of the heavens, seen mostly during winter, or in frosty weather, and clear evenings; it assumes a variety of forms and hues, especially in the polar regions, where it appears in its perfection, and proves a great solace to the inhabitants amidst the gloom of their long winter's night, which lasts from one to six months, while the summer's day which succeeds it lasts in like manner for the same period of time.

Of what nature is the Aurora Borealis?

It is decidedly an electrical phenomenon which takes place in the higher regions of the atmosphere. It is somehow connected with the magnetic poles of the earth; and generally appears in form of a luminous arch, from east to west, but never from north to south.

Phenomenon, an extraordinary appearance. The word is from a Greek one, signifying, to show or appear.

Magnetic, belonging to the magnet, or loadstone.

Luminous, bright, shining.

In what country is it seen constantly from October to Christmas?

In Siberia, where it is remarkably bright. On the western coast of Hudson's Bay, the sun no sooner disappears, than the Aurora Borealis diffuses a thousand different lights and colors with such dazzling [23]beauty, that even the full moon cannot eclipse it.

CHAPTER II.

CORN, BARLEY, PEARL BARLEY, OATS, RYE, POTATOES, TEA, COFFEE, AND CHOCOLATE.

What is Corn?

Corn signifies a race of plants which produce grain in an ear or head, fit for bread, the food of man; or the grain or seed of the plant, separated from the ear.

What is generally meant by Corn?

In this country, maize, or Indian corn, is generally meant; but, in a more comprehensive sense, the term is applied to several other kinds of grain, such as wheat, rye, barley, oats, &c.

Where was Corn first used?

It is uncertain. The Athenians pretend that it was amongst them it was first used; the Cretans, Sicilians, and Egyptians also lay claim to the same. From the accounts in the Bible, we find that its culture engaged a large share of the attention of the ancient Hebrews.

Culture, growth, cultivation. *Hebrews*, the children of Israel, the Jews

Who were the Athenians?

Inhabitants of Athens, the capital city of Greece.

Who were the Cretans?

The inhabitants of Crete, an island of the Archipelago.

Who were the Sicilians?

Inhabitants of Sicily, the largest island of the Mediterranean Sea, now a part of Italy, and separated from the mainland by the Strait of Messina.

Where do the Egyptians dwell?

In Egypt, a country of Africa. It is extremely fertile, producing great quantities of corn. In ancient times it was called the dry nurse of Rome and Italy, from its furnishing with corn a considerable part of the Roman Empire; and we are informed, [24]both from sacred and profane history, that it was anciently the most fertile in corn of all countries of the world. The corn of Syria has always been very superior, and by many classed above that of Egypt.

For what is Barley generally used?

It is very extensively used for making malt, from which are prepared beer, ale, porter, &c.; in Scotland it is a common ingredient in broths, for which reason its consumption is very considerable, barley broth being a dish very frequent there.

Ingredient, a separate part of a body consisting of different materials.

What is Pearl Barley?

Barley freed from the husk by a mill.

What are Oats?

A valuable grain, serving as food for horses. Oats are also eaten by the inhabitants of many countries, after being ground into meal and made into oat cakes. Oatmeal also forms a wholesome drink for invalids, by steeping it in boiling water.

What are the uses of Rye?

In this and some other countries it is much used for bread, either alone or mixed with wheat; in England principally as food for cattle, especially for sheep and lambs, when other food is scarce in winter. Rye yields a strong spirit when distilled.

Distilled, subjected to distillation—the operation of extracting spirit from a substance by evaporation and condensation.

Of what country is the Potato a native?

Potatoes grew wild in Peru, a country of South America; whence they were transplanted to other parts of the American continent, and afterwards to Europe. The honor of introducing this useful vegetable into England is divided between Sir Francis Drake, in 1580, and Sir Walter Raleigh, in 1586, some ascribing it to the former, and others to the latter. It is certain they were obtained from Virginia in the time of Raleigh; they were cultivated only in the gardens of the nobility, and were reckoned a great delicacy. They now constitute a principal article of food [25]in most of the countries of Europe and America; in Ireland, they have long furnished nearly four-fifths of the entire food of the people.

What part of the plant is eaten?

The root, which, when roasted or boiled, affords a wholesome and agreeable meal.

What is Tea?

The leaves of an evergreen shrub, a native of China and Japan, in which countries alone it is extensively cultivated for use. The tea-plant was at one time introduced into South Carolina, where its culture appears to have been attended with but little success. It may yet become a staple production of some portions of the United States.

Evergreen, retaining its leaves fresh and green through all seasons.

How is it prepared for use?

By carefully gathering the leaves, one by one, while they are yet small, young, and juicy. They are then spread on large flat iron pans, and placed over small furnaces, when they are constantly shifted by the hand till they become too hot to be borne.

What is next done?

They are then removed with a kind of shovel resembling a fan, and poured on mats, whence they are taken in small quantities, and rolled in the palm of the hand always in one direction, until they cool and retain the curl.

How often is this operation repeated?

Two or three times, the furnace each time being made less hot. The tea is then placed in the store-houses, or packed in chests, and sent to most of the countries in Europe and America.

Describe the appearance of the Tea-tree.

The Tea-tree when arrived at its full growth, which it does in about seven years, is about a man's height; the green leaves are narrow, and jagged all round; the flower resembles that of [26]the wild rose, but is smaller. The shrub loves to grow in valleys, at the foot of mountains, and on the banks of rivers where it enjoys a southern exposure to the sun; though it endures considerable variation of heat and cold, as it flourishes in the northern clime of Pekin, where the winter is often severe; and also about Canton, where the heat is sometimes very great. The best tea, however, grows in a temperate climate, the country about Nankin producing better tea than either Pekin or Canton, between which two places it is situated.

What produces the difference between Green and Bohea, or Black?

There are varieties of the plant, and the difference of the tea arises from the mode of preparation.

What nation first introduced it into Europe?

The Dutch in 1610; it was introduced into England in 1650

What is Coffee?

The berry of the coffee-tree, a native of Arabia. The coffee-tree is an evergreen, and makes a beautiful appearance at all times of the year, but especially when in flower, and when the berries are red, which is usually during the winter. It is also cultivated in Persia, the East Indies, Liberia on the coast of Africa, the West Indies, Brazil and other parts of South America, as well as in most tropical climates.

Tropical, being within the tropics, that is, in the Torrid Zone.

Who was the original discoverer of Coffee, for the drink of man?

It is not exactly known: the earliest written accounts of the use of Coffee are by Arabian writers in the 15th century; it appears that in the city of Aden it became, in the latter half of that century, a very popular drink, first with lawyers, studious persons, and those whose occupation required wakefulness at night, and soon after, with all classes. Its use gradually extended to other cities, and to those on [27]the eastern shores of the Mediterranean. Towards the end of the seventeenth century, it was carried to Batavia where it was soon extensively planted, and at last young trees were sent to the botanical garden at Amsterdam.

Who introduced it into France and England?

Thevenot, the traveller, brought it into France, and a Greek servant named Pasqua (taken to England by Mr. Daniel Edwards, a Turkey merchant, in 1652, to make his coffee,) first set up the profession of coffee-man, and introduced the drink among the English.

How is it prepared?

The berries are roasted in a revolving metallic cylinder, till they are of a deep brown color, and then ground to powder, and boiled.

Metallic, consisting of metal.

What is Chocolate?

A kind of cake or paste, made of the kernel of the cacao-nut.

Describe the Cacao-nut Tree.

It resembles the cherry tree, and grows to the height of fifteen or sixteen feet. The cacao-nut tree bears leaves, flowers, and fruit, all the year through.

Where does it grow?

In tropical regions, where it is largely cultivated.

Of what form is the fruit?

It is somewhat like a cucumber, about three inches round, and of a yellowish red color. It contains from ten to forty seeds, each covered with a little rind, of a violet color; when this is stripped off, the kernel, of which they make the chocolate, is visible.

How do they make it into a drink?

By boiling it with water or milk. There are various newly-invented ways of preparing chocolate, so that it may be made in a few minutes, by only pouring boiling water upon it.

CHAPTER III.

What is Calico?

A kind of printed cotton cloth, of different colors.

From what place did it take its name?

From Calicut, a city on the coast of Malabar, where it was first made; much is now manufactured in the United States, England, and many other countries.

What is Cotton?

A downy or woolly substance, enclosed in the pod, or seed-vessel, of the cotton-plant. The commercial classification of cotton is determined—1, by cleanliness or freedom from sand, dry leaf, and other impurities; 2, by absence of color; both subject also to character of staple, length, and strength and fineness of fibre. These together determine relative value. There are two general classifications, long-stapled and short-stapled. Of the former the best is the sea island cotton of the United States. The *short staple cotton*, grows in the middle and upper country; the long staple is cultivated in the lower country near the sea, and on the islands near the coasts.

How is it cultivated?

The seeds are sown in ridges made with the plough or hoe; when the plants are mature, the pods open, and the cotton is picked from them.

Where did Cotton anciently grow, and for what was it used?

In Egypt, where it was used by the priests and sacrificers, for a very singular kind of garment worn by them alone.

In what manufacture is it now used?

It is woven into muslins, dimities, cloths, calicoes, &c.; and [29]is also joined with silks and flax, in the composition of other stuffs, and in working with the needle.

How is the Cotton separated from the seed?

By machines called *cotton gins*, of which there are two kinds; the *roller-gin*, and the *saw-gin*. In the former, the cotton, just as gathered from the plant, is drawn between two rollers, placed so closely together as to permit the passage of the cotton, but not of the seeds, which are consequently left behind. In the *saw-gin*, the cotton is placed in a receiver, one side of which consists of a grating of parallel wires, about an eighth of an inch apart; circular saws, revolving on a common axis between these wires, entangle in their teeth the cotton, and draw it from the seeds, which are too large to pass between the wires.

How is it made into Calico, &c.?

The cotton having been separated from the seed, is spun by a machine for the purpose. It is next woven, then dressed, and printed.

What is Cloth?

The word, in its general sense, includes all kinds of stuffs woven in the loom, whether the threads be of wool, cotton, hemp, or flax.

To what is it more particularly applied?

To a web or tissue of woollen threads.

Web, any thing woven.

What is Wool?

The covering or hair of sheep. To prepare it for the weaver, it is first shorn, washed, and dried, then carded or combed by machinery into fibres or threads: formerly this was always performed by the hand, by means of an instrument, called a comb, with several rows of pointed teeth; this, though not much used now, is still occasionally employed, except in large factories. This combing is repeated two or three times, till it is sufficiently smooth and even for spinning. Spinning or converting wool, [30]or cotton, silk, &c. into thread, was anciently performed by the distaff and spindle: these we find mentioned in sacred history, and they have been used in all ages, and in all countries yet discovered. The natives of India, and of some other parts of the world, still employ this simple invention.

What was the next improvement?

The invention of the hand-wheel. In 1767, a machine called the spinning-jenny was invented by a weaver named Hargreaves; but the greatest improvement in the art of spinning was effected by Mr. Arkwright, in 1768: these two inventions were combined, and again improved upon in 1776; so that by the new plan, the material can be converted into thread in a considerably shorter space of time than in the ancient mode; leaving to man merely to feed the machine, and join the threads when they break. The sheep, whose wool forms the material for nearly all woollen clothing, came originally from Africa.

Does weaving differ according to the material used?

The principle of weaving is the same in every kind of fabric, and consists in forming any kind of thread into a flat web, or cloth, by interlacing one thread with another; the various appearances of the manufacture arise as much from the modes in which the threads are interwoven, as from the difference of material.

Is not the employment of Wool in the manufacture of Clothing of great antiquity?

In the earliest records we possess of the arts of mankind, wool is mentioned as forming a chief article in the manufacture of clothing; it is spoken of in the Bible, as a common material for cloth, as early as the time of Moses. The ancient Greeks and Romans are well known to have possessed this art. At the beginning of the thirteenth century, the manufacture was established in many parts of Europe, particularly in Spain, from which country it extended itself to France and Italy. There is no doubt that it was introduced into England by its conquer[31]ors the Romans, a manufactory being established at Winchester, sufficiently large to supply the Roman army.

Manufactory, a place where things are made or manufactured; derived from the Latin *manus*, a hand, and the verb *facio*, to do or make.

What circumstance contributed to the progress of this manufacture among the English?

In 1330, the English, being desirous of improving their woollen manufacture, invited over the Flemings, by the offer of various privileges, to establish manufactories there. The skill of these people soon effected a great improvement in the English fabrics, so that there no longer remained any occasion for the exportation of English wool into Flanders, to be manufactured into fine cloth; and a law was passed by the government to forbid it. Both the cotton and woollen manufactures have, of late years, arisen to great importance in the United States.

What country affords the best Wool?

The wool of Germany is most esteemed at the present day: that of Spain was formerly the most valuable, but the Spanish breed of sheep, having been introduced into Germany, succeeded better there than in Spain, and increased so rapidly, that the Spanish wool trade has greatly diminished. Australia is one of the principal wool-growing countries in the world, for the breed of sheep sent out to that country and Tasmania has succeeded remarkably well.

What part of the world is meant by Australia?

A British Island in the South Pacific Ocean, comprising the Colonies of Queensland, New South Wales, Victoria, South Australia, and Western Australia. It is the principal of the group of large islands, in the Oriental Archipelago. Tasmania is another of the same group, separated from New South Wales by a channel called Bass's Strait, and also belongs to Great Britain.

What is meant by an Archipelago?

A part of a sea studded with numerous islands; but the term [32]is more particularly applied to that lying between Europe and Asia, which contains the Greek Islands. The word is a corruption from the Greek, signifying the Ægean Sea.

Is the Wool of the sheep all of one quality?

No; it varies according to the species of sheep, the soil on which they are fed, and the part of the animal from which it is taken: the chief distinction is between the long and the short wool; the long wool is employed in the manufacture of carpets, crapes, blankets, &c.; and the finer and shorter sorts for hosiery, broadcloths &c.

Where were Carpets originally made?

Carpets are of oriental origin, and are made of different sorts of stuffs; they are woven in a variety of ways. Persian and Turkey carpets are most esteemed; they are woven in a piece, in looms of a very simple construction. Formerly the manufacture of these carpets was confined to Persia and Turkey; but they are now successfully made, both in Europe and the United States, &c. Great Britain is the principal seat of the carpet manufacture of the world. Brussels, Wilton, and Kidderminster carpets derive their names from the places where they were invented.

Is not the art of weaving very ancient?

It appears to have been known from a period as early as the time of Abraham and Jacob; its inventor is not known, but it is possible that men took a lesson from the ingenious spider, which weaves its web after the same manner. The ancient Egyptians appear to have brought it to great perfection, and were even acquainted with the art of interweaving colors after the manner of the Scottish plaid.

What is Baize?

A coarse, open, woollen stuff, with a long nap. It is chiefly made in the United States, England, France, &c.

What is Linen?

There are various kinds of linen, made from cotton, flax, and hemp; but the term is chiefly applied to that woven with the [33]two last mentioned. Linen means cloth of flax; hence its derivation from the Latin word *linum*, flax.

What is Flax?

An annual plant, the fibres of which are beaten into threads, spun, and afterwards woven into linen; it is extensively cultivated in the United States, Russia, and some other countries of Europe. Hemp is a plant of a similar nature, equally used with flax, in the

manufacture of linens. Russian hemp is cultivated to a larger extent than that of any other country, and is considered the best that is grown.

How long has the use of Hemp and Flax been known?

Those plants are said to be natives of Persia, and introduced from some parts of the East into Europe, over which it is now widely distributed: it existed both in a wild and cultivated state, in some parts of Russia, as early as five centuries before Christ These products form a considerable article of exportation, besides the quantity used in Russia itself; a considerable part is wrought into linens, diapers, canvas, and other manufactures; and even the seeds are exported, both in their natural state and as oil. In various parts of Russia, hemp-seed oil and flax-seed (or linseed) oil are prepared in very large quantities.

What is Diaper?

A sort of linen cloth, woven in flowers, and other figures; it is said to have received its name from d'Iper, now Ypres, a town of Belgium, situated on a river of the same name, where it was first made.

What is Holland?

A fine, close, even, linen cloth, used for sheets, &c. It obtained its name from being principally made in Holland.

What is Canvas?

A hempen cloth, so loosely woven as to leave interstices between the threads, in little squares. It is used for working in patterns upon it with wools, &c.; by painters for a ground work on which they draw their pictures; for tents, sails, and [34]many other purposes. There are several sorts, varying in the fineness of their texture.

What is Damask?

A sort of silken stuff, having some parts raised on its surface to represent flowers or figures. It took its name from Damascus, in Syria, whence it was first brought.

Is there not another sort of Damask?

Yes, made from linen; and so called because its large flowers resemble those of damask roses. It was first made in Flanders, and is used for table linen, &c.

What is Flannel?

A slight, loose, woollen stuff, used for warm clothing; it was originally made in Wales, where it still continues to be manufactured in great perfection.

CHAPTER IV.

COCOA, TODDY, CHERRIES, BARK, CORK, COCHINEAL, CLOVES, CINNAMON, AND CASSIA.

Of what form is the tree which bears those large nuts, called Cocoa nuts?

It is tall and straight, without branches, and generally about thirty or forty feet high; at the top are twelve leaves, ten feet long, and half a foot broad; above the leaves, grows a large excrescence in the form of a cabbage, excellent to eat, but taking it off kills the tree. The cocoa is a species of Palm.

Is not the Indian liquor called Toddy, produced from the Cocoa Tree?

Yes, between the leaves and the top arise several shoots about the thickness of a man's arm, which, when cut, distil a white,[35]sweet, and agreeable liquor; while this liquor exudes, the tree yields no fruit; but when the shoots are allowed to grow, it puts out a large cluster or branch, on which the cocoa nuts hang, to the number of ten or twelve.

Distil, to let fall in drops.

Exude, to force or throw out.

THE CATHEDRAL OF MILAN, ITALY.

How often does this tree produce nuts?

Three times a year, the nuts being about the size of a man's head, and of an oval form.

Of what countries is it a native?

Of Asia, the Indies, Africa, Arabia, the Islands of the Southern Pacific, and the hottest parts of America.

What are the uses of this Tree?

The leaves of the tree are made into baskets; they are also used for thatching houses: the fibrous bark of the nut, and the trunk of the tree, are made into cordage, sails, and cloth; the shell, into drinking bowls and cups; the kernel affords a wholesome food, and the milk contained in the shell, a cooling liquor.

From what country was the Cherry Tree first brought?

From Cerasus, a city of Pontus, in Asia, on the southern borders of the Black Sea; from which place this tree was brought to Rome, in the year of that city 680, by Lucullus; it was conveyed, a hundred and twenty-eight years after, into Great Britain, A.D. 55.

What is the meaning of A.D.?

A short way of writing Anno Domini, Latin words for *in the year of our Lord*.

Who was Lucullus?

A renowned Roman general.

Is the wood of the Cherry Tree useful?

It is used in cabinet-making, for boxes, and other articles.

What is Bark?

The exterior part of trees, which serves them as a skin or covering.

Exterior, the outside.

[36]

Does it not undergo some change during the year?

Each year the bark of a tree divides, and distributes itself two contrary ways, the outer part gives towards the skin, till it becomes skin itself, and at length falls off; the inner part is added to the wood. The bark is to the body of a tree, what the skin of our body is to the flesh.

Of what use is Bark?

Bark is useful for many things: of the bark of willows and linden trees, ropes are sometimes made. The Siamese make their cordage of the cocoa tree bark, as do most of the Asiatic and African nations; in the East Indies, they make the bark of a certain tree

into a kind of cloth; some are used in medicines, as the Peruvian bark for Quinine; others in dyeing, as that of the alder; others in spicery, as cinnamon, &c.; the bark of oak, in tanning; that of a kind of birch is used by the Indians for making canoes.

What are Canoes?

Boats used by savages; they are made chiefly of the trunks of trees dug hollow; and sometimes of pieces of bark fastened together.

How do the savages guide them?

With paddles, or oars; they seldom carry sails, and the loading is laid in the bottom.

Are not the savages very dexterous in the management of them?

Yes, extremely so; they strike the paddles with such regularity, that the canoes seem to fly along the surface of the water; at the same time balancing the vessels with their bodies, to prevent their overturning.

Dexterous, expert, nimble.

Do they leave their canoes in the water on their return from a voyage?

No, they draw them ashore, hang them up by the two ends, and leave them to dry; they are generally so light as to be easily carried from [37]place to place.

Were not books once made of Bark?

Yes, the ancients wrote their books on the barks of many trees, as on those of the ash and the lime tree, &c.

Which part did they use?

Not the exterior or outer bark, but the inner and finer, which is of so durable a texture, that there are manuscripts written on it which are still extant, though more than a thousand years old.

Is it not also used in Manure?

Yes, especially that of the oak; but the best oak bark is used in tanning.

What is Cork?

The thick, spongy, external bark of the Cork Tree, a species of oak. There are two varieties of this tree, the broad-leaved and the narrow: it is an evergreen, and grows to the height of thirty feet. The Cork Tree attains to a very great age.

Where is the Tree found?

In Spain, Italy, France, and many other countries. The true cork is the produce of the broad-leaved tree.

What are its uses?

Cork is employed in various ways, but especially for stopping vessels containing liquids, and, on account of its buoyancy in water, in the construction of life boats. It is also used in the manufacture of life preservers and cork jackets. The greatest quantities are brought from Catalonia, in Spain. The uses of Cork were well known to the ancients.

To what particular use did the Egyptians put it?

They made coffins of it, lined with a resinous composition, which preserved the bodies of the dead uncorrupted.

What is Cochineal?

A drug used by the dyers, for dyeing crimsons and scarlets; and for making carmine, a brilliant red used in painting, and several of the arts.

Is it a plant?

No, it is an insect. The form of the Cochineal is oval; it [38]is about the size of a small pea, and has six legs armed with claws, and a trunk by which it sucks its nourishment.

What is its habitation?

It breeds in a fruit resembling a pear; the plant which bears it is about five or six feet high; at the top of the fruit grows a red flower, which when full blown, falls upon it; the fruit then appears full of little red insects, having very small wings. These are the Cochineals.

How are they caught?

By spreading a cloth under the plant, and shaking it with poles, till the insects quit it and fly about, which they cannot do many minutes, but soon tumble down dead into the cloth; where they are left till quite dry.

Does the insect change its color when it is dead?

When the insect flies, it is red; when it is fallen, black; and when first dried, it is greyish; it afterwards changes to a purplish grey, powdered over with a kind of white dust.

From what countries is the Cochineal brought?

From the West Indies, Jamaica, Mexico, and other parts of America.

What are Cloves?

The dried flower-buds of the Clove Tree, anciently a native of the Moluccas; but afterwards transplanted by the Dutch (who traded in them,) to other islands, particularly that of Ternate. It is now found in most of the East Indian Islands.

Describe the Clove Tree.

It is a large handsome tree of the myrtle kind; its leaves resemble those of the laurel. Though the Clove Tree is cultivated to a great extent, yet, so easily does the fruit on falling take root, that it thus multiplies itself, in many instances, without the trouble of culture. The clove when it first begins to appear is white, then green, and at last hard and red; when dried, it turns yellow, and then dark brown.

What are its qualities?

The Clove is the hottest, and most acrid of aromatic substances; one of our most wholesome spices, and of great use in medicine; it also yields an abundance of oil, which is much used by perfumers, and in medicine.

Acrid, of a hot, biting taste.

Aromatic, fragrant, having an agreeable odor.

What is Cinnamon?

An agreeable, aromatic spice, the bark of a tree of the laurel kind; the Cinnamon tree grows in the Southern parts of India; but most abundantly in the island of Ceylon, where it is extensively cultivated; its flowers are white, resembling those of the lilac in form, and are very fragrant; they are borne in large clusters. The tree sends up numerous shoots the third or fourth year after it has been planted; these shoots are planted out, when nearly an inch in thickness.

How is the bark procured?

By stripping it off from these shoots, after they have been cut down; the trees planted for the purpose of obtaining cinnamon, throw out a great number of branches, apparently from the same root, and are not allowed to rise higher than ten feet; but in its native uncultivated state, the cinnamon tree usually rises to the height of twenty or thirty feet.

How is the Cinnamon Tree cultivated?

By seed, sown during the rains; from shoots cut from large trees; and by transplanting old stumps. The cinnamon tree, in its wild state, is said to be propagated by means of a kind of pigeons, that feed on its fruit; in carrying which to their nests, the seeds fall out, and, dropping in various places, take root, spring up, and become trees.

Propagated, spread, extended, multiplied.

What else is obtained from this tree?

The bark, besides being used as a spice, yields an oil highly [40]esteemed, both as a medicine and as a perfume; the fruit by boiling also produces an oil, used by the natives for burning in lamps; as soon as it hardens, it becomes a solid substance like wax, and is formed into candles. Camphor is extracted from the root. Cassia is cinnamon of an inferior kind.

CHAPTER V.

BOMBAZINE, CRAPE, CAMLET, CAMBRIC, LACE, SILK, VELVET, AND MOHAIR.

What is Bombazine?

A stuff composed of silk and wool woven together in a loom. It was first made at Milan, and thence sent abroad; great quantities are now made in England and other countries.

Where is Milan situated?

In Italy, and is noted for its cathedral.

For what is Bombazine used?

For dresses. Black bombazine is worn entirely for mourning. The original bombazine has, however, become much less used than formerly, on account of the numerous newly-invented fabrics of finer or coarser qualities, composed of the same materials mixed in various degrees, as Mousselines de laine, Challis, &c.

What is Crape?

A light, transparent stuff, resembling gauze, made of raw silk very loosely woven, or of wool; by raw silk is meant, silk in the state in which it is taken from the silk worm.

Where was Crape first made?

At Bologna, a city of Italy.

What city of France was long celebrated for its manufacture?

Lyons, the second city of France, where there are large silk [41]manufactories. Great quantities are also made in England, principally in the city of Norwich, which has long been distinguished for the beauty of its crapes.

What is Camlet?

A stuff made sometimes of wool, sometimes of silk and hair, especially that of goats. The oriental camlet is made of the pure hair of a sort of goat, a native of Angora, a city of Natolia, in Turkey. The European camlets are made of a mixture of woollen thread and hair.

What countries are most noted for them?

England, France, Holland, and Flanders; the city of Brussels, in Belgium, exceeds them all in the beauty and quality of its camlets; those of England are the next.

What is Cambric?

A species of linen made of flax; it is very fine and white.

From whence did it take its name?

From Cambray, a large and celebrated city of French Flanders, where it was first made; it is now made at other places in France; and also in England, Scotland, Ireland, the United States, &c.

What is Lace?

A work composed of many threads of fine linen or silk, interwoven one with another according to some particular pattern. Belgium, France, and England are the principal countries in which this manufacture is carried on; vast quantities of the finest laces were formerly made in Flanders.

From what is Silk produced?

From the silk-worm, an insect not more remarkable for the precious matter it furnishes, than for the many forms it assumes before and after it envelopes itself in the beautiful ball, the silken threads of which form the elegant texture which is so much worn.

Texture, a web or substance woven.

What are the habits of this insect, and on what does it feed?

After bursting from the egg, it becomes a large worm or caterpillar of a yellowish white color, (which is its first state;) this caterpillar feeds on the leaves of the mulberry tree, till, arriving at maturity, it winds itself up in a silken bag or case, called a cocoon, about the size and shape of a pigeon's egg, and becomes a chrysalis; in which state it lies without signs of life; in about ten days it eats its way out of its case, a perfect butterfly, which lays a number of eggs and then dies. In the warmth of the summer weather, these eggs are hatched, and become worms, as their parents did at first.

Maturity, ripeness, perfection

How much silk is each ball said to contain?

Each ball consists of a very fine, soft, bright, delicate thread, which being wound off, extends in length six miles.

What is meant by Chrysalis?

The second state into which the insect passes before it comes to be a butterfly. The maggot or worm having ceased to eat, fixes itself in some place till its skin separates, and discovers a horny, oblong body, which is the chrysalis.

Where was Silk first made?

The culture and manufacture of silk was originally confined to China. The Greeks, under Alexander the Great, brought home, among other Eastern luxuries, wrought silks from Persia, about 323, B.C. It was not long unknown to the Romans, although it was so rare, that it was even sold weight for weight with gold. The Emperor Aurelian, who died in 275, B.C. refused the Empress, his wife, a suit of silk which she solicited with much earnestness, merely on account of its dearness. Heliogabalus, the Emperor, who died half a century before Aurelian, was the first who wore a *holosericum* or garment all of silk.

Who introduced the Silk Worm itself into Europe?

Two monks, engaged as missionaries in China, obtained a quantity of silk worms' eggs, which they concealed in a hollow cane, and conveyed in safety to Constantinople in 552; the eggs were hatched in the proper season by the warmth of manure, and the worms fed with the leaves of the wild mulberry tree. These worms in due time spun their silk, and propagated under the care of the monks, who also instructed the Romans in the whole process of manufacturing their production. From the insects thus produced, proceeded all the silk worms which have since been reared in Europe, and the western parts of Asia. The mulberry tree was then eagerly planted, and on this, their natural food, they were successfully reared in Greece; and the manufacture was established at Thebes, Athens, and Corinth, in particular. The Venetians, soon after this time commencing a trade with the Greeks, supplied all the Western parts of Europe with silks for many centuries.

Where were the cities of Thebes and Athens situated?

Thebes was an ancient city of Beotia, in Greece, founded by Cadmus, a Phenician, though of Egyptian parentage. Sailing from the coast of Phenicia, he arrived in Beotia, and built the city, calling it Thebes, from the city of that name in Egypt. To this prince

is ascribed the invention of sixteen letters of the Greek Alphabet. Athens was the capital of Attica, founded by Cecrops, an Egyptian. It was the seat of learning and the arts, and has produced some of the most celebrated warriors, statesmen, orators, poets, and sculptors in the world. Since the emancipation of Greece from the cruel bondage of its conquerors the Turks, who had oppressed it for three centuries, Athens has been chosen as its capital, and is still a considerable town adorned with splendid ruins of the beautiful buildings it once possessed. Thebes and Corinth, another celebrated city, are now only villages.[44]

Warrior, a soldier.

Statesmen, men versed in the arts of government.

Orator, a public speaker.

Poet, one who composes poetry.

Sculptor, one who cuts figures in stone, marble, or ivory.

Who were the Venetians?

Inhabitants of Venice, a city of Italy.

Did this manufacture continue to be confined to the Greeks and Venetians?

By no means. The rest of Italy, and Spain, by degrees learnt the art from some manufactories in Sicily; and about the reign of Francis the First, the French became masters of it. It, however, long remained a rarity; their King, Henry the Second, is supposed to have worn the first pair of knit silk stockings. The Fourth Henry encouraged the planting of mulberry trees; his successors also did the same, and the produce of silk in France is now very considerable.

When was the manufacture of silk introduced into England?

There was a company of silk women in England as early as the year 1455; but they probably were merely employed in needlework of silk and thread, for Italy supplied England with the broad manufacture during the chief part of the fifteenth century. The great advantage this new manufacture afforded, made King James the First very desirous for its introduction into England, particularly in 1608, when it was recommended, in very earnest terms, to plant mulberry trees for the rearing of silk worms; but unhappily without effect. However, towards the latter end of this reign, the broad silk manufacture was introduced, and with great success. The revocation of the Edict of Nantes contributed greatly to its promotion, by the number of French workmen who took refuge in England; to them the English are indebted for the art of manufacturing many elegant kinds of silks, satins, velvets, &c., which had formerly

been imported from abroad up to the year 1718. The silk manu[45]facture has also been successfully introduced into some portions of the United States.

Revocation, act of recalling, repeal.

Imported, brought into.

What was the Edict of Nantes?

A law made in favor of the Protestants, the repealing of which drove many of their most skilful workmen to take refuge in England. They were kindly received, and settled in Spitalfields, and many other parts of England as well as Ireland, where they carried on a flourishing and ingenious manufacture.

Were the attempts to rear Silk Worms in England successful?

No; after many trials, all of which failed, attention was directed to the establishments for procuring both raw and wrought silks, in the settlements in India belonging to Britain; this was attended with complete success, the climate being extremely favorable, and the price of labor cheap. Raw silk is imported in quantities from India, China, Italy, &c.

How is the Silk taken from the Worm?

The people who are employed in the care of these insects collect the golden balls from off the mulberry trees, (to the leaves of which the insects glue their silk) and put them into warm water, that the threads may unfasten and wind off more easily; having taken off the coarse woolly part which covers the balls, they take twelve or fourteen threads at a time, and wind them off into skeins. In order to prepare this beautiful material for the hand of the weaver to be wrought into silks, stuffs, brocades, satins, velvets, ribbons, &c., it is spun, reeled, milled, bleached, and dyed.

Milled, worked in a kind of mill.

Bleached, whitened.

What is Velvet?

A rich kind of stuff, all silk, covered on the outside with a close, short, fine, soft shag; the wrong side being very strong and close. The principal number, and the best velvets, were made in France and Italy; others in Holland; they are now[46] brought to great perfection in England. An inferior kind is made by mixing cotton with the silk. Velvet has been known in Europe for some centuries, but its manufacture was long confined to some of the chief cities of Italy. From that country the French learned the art, and greatly improved it.

Whence is the word Velvet derived?

From the Italian word *velluto*, signifying velvet, which comes from *vellus*, hair or fleece.

What is Mohair?

The hair of a kind of goat, common about Angora, in Turkey. It is used in the manufacture of various kinds of stuffs, shawls, &c.

Is there not another animal much celebrated for the material it furnishes in the making of shawls?

Yes; the Thibet goat. The wool is sent to Cashmere, where it is spun and dyed. Cashmere is situated in the north-west extremity of India, and has long been celebrated for the beautiful and valuable shawls bearing its name which are manufactured there. The goats are beautiful creatures, with long, fine, wavy hair, reaching nearly to the ground, so as almost to conceal their legs. The material of which the shawls are made is a fine silky down, which grows under the long hair, next to the skin.

CHAPTER VI.

CURRANTS, RAISINS, FIGS, RICE, SUGAR, SUGAR CANDY, &C., SAGO, MILLET, GINGER, NUTMEG, MACE, PIMENTO OR ALLSPICE, PEPPER, AND CAYENNE PEPPER.

What are Currants?

A kind of small raisins or dried grapes.

Whence are they brought?

From several islands of the Archipelago, particularly Zante and Cephalonia; and from the Isthmus of Corinth, in Greece.

Do they grow on bushes like our Currants?

No, on vines like other grapes, except that the leaves are somewhat thicker, and the grapes much smaller: they have no pips, and are of a deep red, or rather black color.

When are they gathered, and how are they dried?

They are gathered in August, and laid on the ground in heaps till dry; they are then cleaned, and put into magazines, from which they are taken and packed in barrels for exportation.

What do you mean by Exportation?

The act of conveying goods for sale from one country to another.

What are Raisins?

Grapes prepared by drying them in the sun, or by the heat of an oven. Raisins of Damascus, so called from the capital city of Syria, near which they are cultivated, are very large, flat, and wrinkled on the surface; soft and juicy inside, and nearly an inch long. Raisins of the sun, or jar raisins, so called from being imported in jars, are all dried by the heat of the sun; they are of a reddish blue color, and are the produce of Spain, whence the finest and best raisins are brought. There are several other sorts, named either from the place in which they grow, or the kind of grape of which they are made, as those of Malaga, Valencia, &c.

In what manner are they dried?

The common way of drying grapes for raisins, is to tie two or three bunches of them together while yet on the vine, and dip them into a lye made of hot wood-ashes, mixed with a little olive oil. This makes them shrink and wrinkle: after this they are cut from the branches which supported them, but left on the vine for three or four days, separated on sticks, in an upright position, to dry at leisure. Different modes, however, are adopted, according to the quality of the grape. The commonest kinds are dried in hot ovens, but the best way is that in which [48]the grapes are cut when fully ripe, and dried by the heat of the sun, on a floor of hard earth or stone.

Lye, a liquor made from wood-ashes; of great use in medicine, bleaching, sugar works, &c.

What are Figs?

A soft, luscious fruit, the produce of the fig-tree. The best figs are brought from Turkey, but they are also imported from Italy, Spain, and the southern part of France. The islands of the Archipelago yield an inferior sort in great abundance. In this country they are sometimes planted in a warm situation in gardens, but, being difficult to ripen, they do not arrive at perfection. The figs sent from abroad are dried by the heat of the sun, or in furnaces for the purpose.

Luscious, sweet to excess, cloying.

What is Rice?

A useful and nutritious grain, cultivated in immense quantities in India, China, and most eastern countries; in the West Indies, Central America, and the United States; and in southern Europe. It forms the principal food of the people of eastern and southern Asia,

and is more extensively consumed than any other species of grain, not even excepting wheat.

Nutritious, wholesome, good for food.

Does it not require a great deal of moisture?

Yes, it is usually planted in moist soils, and near rivers, where the ground can be overflowed after it is come up. The Chinese water their rice-fields by means of movable mills, placed as occasion requires, upon any part of the banks of a river; the water is raised in buckets to a proper height, and afterwards conveyed in channels to the destined places.

What is Sugar?

A sweet, agreeable substance, manufactured chiefly from the Sugar Cane,[1] a native of the East and West Indies, South America and the South Sea Islands; it is much cultivated in all tropical countries. The earliest authentic accounts of sugar, are [49]about the time of the Crusades,[2] when it appears to have been purchased from the Saracens, and imported into Europe.

[1] Most of the sugar in Europe is made from beets.

[2] See Chapter XVII., article Navigation.

Authentic, true, certain.

Crusades, holy wars.

Saracens, Turks or Arabs.

How is it prepared?

The canes are crushed between large rollers in a mill, and the juice collected into a large vessel placed to receive it; it is then boiled, and placed in pans to cool, when it becomes imperfectly crystallized, in which state we use it. This is called raw or soft sugar: loaf sugar, or the hard white sugar, is the raw brown sugar, prepared by refining it till all foreign matter is removed.

Is the Sugar Cane the only vegetable that produces Sugar?

All vegetables contain more or less sugar, but the plant in which it most abounds is the sugar-cane. In the United States, a large quantity of sugar is prepared from the sap of the Sugar Maple Tree. The trees are tapped at the proper season by a cut being made in the bark, and the juice runs into a vessel placed to receive it; it is then prepared in the same manner as the juice of the sugar cane.

What is Sugar Candy?

Sugar purified and crystallized.

What is Barley Sugar?

Sugar boiled till it is brittle, and cast on a stone anointed with oil of sweet almonds, and then formed into twisted sticks.

What is Sago?

A substance prepared from the pith of the Sago Palm, which grows naturally in various parts of Africa and the Indies. The pith, which is even eatable in its natural state, is taken from the trunk of the tree, and thrown into a vessel placed over a horse-hair sieve; water is then thrown over the mass, and the finer parts of the pith pass through the sieve; the liquor thus obtained is left to settle. The clear liquor is then drawn off, [50]and what remains is formed into grains by being passed through metal dishes, with numerous small holes; it is next dried by the action of heat, and in this state it is exported. The Sago Palm also produces sugar.

What is Millet, and in what countries does it grow?

Millet is an esculent grain, originally brought from the Eastern countries. It is cultivated in many parts of Europe, but most extensively in Egypt, Syria, China, and Hindostan, whence we are furnished with it, it being rarely cultivated among us, except as a curiosity.

Esculent, good for food.

For what is Millet used?

It is in great request amongst the Germans for puddings; for which it is sometimes used amongst us. The Italians make loaves and cakes of it.

What is Ginger?

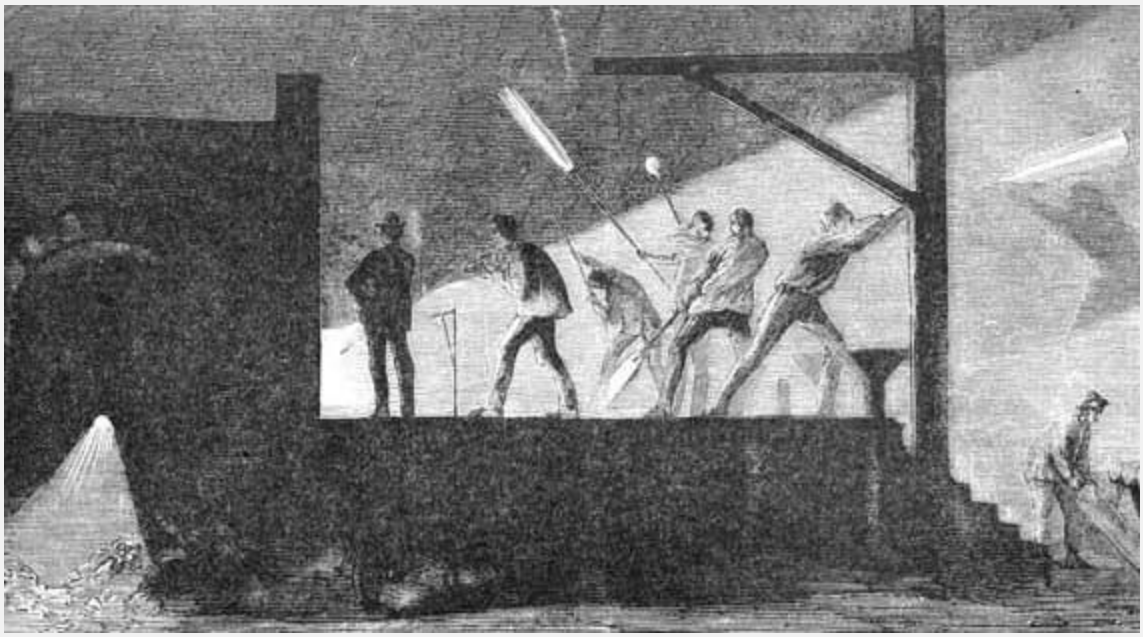
The root of a plant cultivated in the East and West Indies, and in America; it is a native of South-eastern Asia and the adjoining islands.

Describe its nature and use.

It is a warm aromatic, much used in medicine and cookery. The Indians eat the root when green as a salad, chopping it small with other herbs; they also make a candy of it with sugar. The ginger sold in the shops here is dried, which is done by placing the roots in the heat of the sun or in ovens, after being dug out of the ground. Quantities not only of the dried root, but also of the candied sugar, are imported.

What are Nutmegs?

A delicate aromatic fruit or spice, brought from the East Indies. The nutmeg tree greatly resembles our pear tree, and produces a kind of nut, which bears the same name as the tree.



GLASS BLOWING AT THE GLASS-WORKS, PITTSBURGH, PA.

What is the appearance of the Nutmeg?

Its form is round, and its smell agreeable. The nutmeg is [51]inclosed in four different covers; the first, a thick fleshy coat, (like our walnut,) which opens of itself when ripe; under this lies a thin reddish network, of an agreeable smell and aromatic taste, called mace; this wraps up the shell, which opens as the fruit grows. The shell is the third cover, which is hard, thin, and blackish; under this is a greenish film of no use; and in the last you find the nutmeg, which is the kernel of the fruit.

What are its uses?

The nutmeg is much used in our food, and is of excellent virtue as a medicine. It also yields an oil of great fragrance.

Is the Mace used as a spice?

Yes, it is separated from the shell of the nutmeg, and dried in the sun. It is brought over in flakes of a yellow color, smooth and net-like, as you see it in the shops. Its taste is warm, bitterish, and rather pungent; its smell, aromatic. It is used both in food and medicine, as the nutmeg, and also yields an oil.

Pungent, of a hot, biting taste.

What is Pimento or Allspice?

The dried unripe berry or fruit of a tree growing in great abundance in Jamaica, particularly on the northern side of that island, on hilly spots, near the coast; it is also a native of both Indies. The Pimento Tree is a West Indian species of Myrtle; it grows to the height of twenty or thirty feet; the leaves are all of a deep, shining green, and the blossom consists of numerous branches of small, white, aromatic flowers, which render its appearance very striking; there is scarcely in the vegetable world any tree more beautiful than a young Pimento about the month of July, when it is in full bloom.

When is the time to gather the spice?

About the month of September, not long after the blossoms are fallen, the berries are gathered by the hand; one laborer on the tree, employed in gathering the small branches, will give employment to three below (who are generally women and [52]children) in picking the berries. They are then spread out thinly, and exposed to the sun at its rising and setting for some days; when they begin to dry, they are frequently winnowed, and laid on cloths to preserve them better from rain and dew; by this management they become wrinkled, and change from green to a deep reddish brown color. Great quantities are annually imported.

What are its uses?

It forms a pleasant addition to flavor food; it also yields an agreeable essential oil, and is accounted the best and mildest of common spices.

Essential, pure; extracted so as to contain all the virtues of the spice in a very small compass.

Why is it called Allspice?

Because it has been supposed to combine the flavor of cloves, nutmegs, and cinnamon; the French call it *round clove*, from its round shape, and the taste being somewhat like that spice.

What is Pepper?

The product of a creeping shrub, growing in several parts of the East Indies, Asia, and America.

In what manner does Pepper grow, and what part of the shrub is used?

Pepper is the fruit of this shrub, and grows in bunches or clusters, at first green; as it ripens it becomes reddish, until having been exposed for some time to the heat of the sun, (or probably gathered before perfectly ripe,) it becomes black, as in the condition we have it. There are two sorts, the black and the white.

What is the White Pepper?

The white pepper is merely the black deprived of its outside skin. For this purpose the finest red berries are selected, and put in baskets to steep, either in running water, or in pits dug for the purpose, near the banks of rivers. Sometimes they are only buried in the ground. In any of these situations, they [53]swell and burst their skins, from which, when dry, they are carefully separated by rubbing between the hands, or fanning.

What is Cayenne Pepper?

The dried fruit of a plant called bird pepper, a native of both Indies. It is more pungent than the other sorts.

CHAPTER VII.

GLASS, MIRRORS, EARTHENWARE, PORCELAIN, NEEDLES, PINS, PAPER, PRINTING, PARCHMENT, AND VELLUM.

What is Glass?

A transparent, solid, brittle, factitious body, produced by fusing sand with an alkali. The essential ingredients of glass are silex and potash, or soda; a few other substances are sometimes added. Silex is found nearly pure in rock crystal, flint, and other varieties of quartz; for the manufacture of the better kinds of glass in this country, it is generally obtained from sand, especially the white sand of New Jersey.

Factitious, made by art, not found in a state of nature.

What is Potash?

The saline matter obtained from the ashes of wood, by causing water to pass through them; the water imbibes the salt, which is then obtained from it by evaporation. When purified by calcination, it is termed pearlash. In countries where there are vast forests, as in America and Russia, it is manufactured on a very large scale.

What can you say of the origin of Glass?

The period of its invention is quite unknown. Pliny relates that some merchants, driven by a storm to the coast of Phenicia, near the river Belus, made a large fire on the sand to dress [54]some food, using as fuel some of the plant Kali, which grew there in great abundance; an imperfect glass was thus formed by the melting of the sand and ashes together. This production was picked up by a Syrian merchant, who, attracted by its great beauty, examined the cause of its origin, and, after many attempts, succeeded in its manufacture.

Who was Pliny?

A celebrated Roman naturalist and historian.

At what place was Glass first made?

Some authors mention Sidon in Syria, which became famous for glass and glass-houses; but others maintain that the first glass-houses noticed in history were built at Tyre; which, they add, was the only place where glass was made for many ages. It is certain that the art was known to the Egyptians.

What is Phenicia?

A sub-division of Syria in Asia.

What is an author?

A person who writes a book.

What is signified by a glass-house?

A building erected for the making and working of glass.

What countries had glass windows first?

Italy, then France and England; they began to be common about the year 1180.

In what year, and where, was the making of glass bottles begun?

In 1557, in London. The first glass plates for mirrors and coach-windows were made at Lambeth, in 1673.

What is a Mirror?

A body which exhibits the images of objects presented to it by reflection. The word mirror is more peculiarly used to signify a smooth surface of glass, tinned and quicksilvered at the back,[3] which reflects the images of objects placed before it.

[3] See Chapter XII., article Mercury.

Are they a modern invention?

The use of mirrors is very ancient; mention is made of brazen mirrors or looking-glasses in Exodus, the 38th chapter and 8th verse. Some modern commentators will not admit the mirrors themselves to have been of brass, but of glass set or framed in brass; but the most learned among the Jewish rabbins say that in those times the mirrors made use of by the Hebrew women in dressing their heads were of metal, and that the devout women mentioned in this passage made presents to Moses of all their mirrors to make the brazen

laver for the Tabernacle. It might likewise be proved that the ancient Greeks made use of brazen mirrors, from many passages in the ancient poets.

Commentators, explainers of passages in the Bible, &c.

Rabbins, doctors among the Jews, their learned men or teachers.

What nation invented the large looking-glass plates now in use?

The French.

What city of Italy excelled all Europe for many years in the making of fine glass?

Venice. The manufacture of fine glass was first introduced into England by Venetian artists in 1078.

Of what is Earthenware composed?

Of clay, and those earths which are capable of being kneaded into a paste easily receiving any form, and acquiring solidity by exposure to fire: sand, chalk, and flint are likewise mixed with clay.

In what manner is it formed into such a variety of shapes?

The flint or sand, and soft clay, are mixed together in various proportions for the different kinds of ware; this paste is afterwards beaten till it becomes fit for being formed at the wheel into plates, dishes, basins, &c. These are then put into a furnace and baked; after which they are glazed.

What nation so greatly excelled in the manufacture of a beautiful species of Earthenware?[56]

The Chinese,—who, as far as can be ascertained, were its inventors. Porcelain is a fine sort of earthenware, chiefly made in China, whence it was called China or China-ware; it is also brought from many parts of the East, especially from Japan, Siam, Surat, and Persia. The art of making porcelain was one of those in which Europe had been excelled by oriental nations; but for many years past earthenwares have been made in different parts of Europe, so like the oriental, that they have acquired the name of porcelain. The first European porcelains were made in Saxony and France, and afterwards in England, Germany, and Italy, all of which differed from those of Japan and China, but each possessing its peculiar character. They are now brought to great perfection in Europe, particularly in England, France and Prussia.

Before the invention of Earthenware, what supplied its place to the early inhabitants of the world?

The more civilized the inhabitants of any country became, the more they would perceive the convenience of possessing vessels of various descriptions for holding or preparing their food; some of the objects which first presented themselves would be the larger kinds of shells; and, in hot climates, the hard coverings of the cocoa-nut or gourd. In some cases the skins of beasts were used, as they still are in the East, where they are sewed together, and formed into a kind of bottle to hold milk, wine, &c.; but the people of colder climates would not be able to avail themselves of these natural productions, and would be obliged to make use of other substances.

What, then, would they employ?

Clay, which in many countries is found in great abundance, from its adhesive property, and its retaining its form when dry, and becoming insoluble in water after having been baked in the fire, would naturally attract the attention of an improving people: from this it arises that the early remains of culinary and other vessels which have been discovered have been formed of this material. Among the remains of ancient Egypt, numerous vessels have been found formed of common clay baked in the fire; and, though of rude workmanship, extremely elegant in form.[57]

Adhesive, sticky; apt or tending to adhere.

Insoluble, not capable of being dissolved.

Culinary, belonging to cooking or domestic purposes.

Of what are Needles made?

Of steel; and though exceedingly cheap, they go through a great number of operations before they are brought to perfection. It was in the reign of Queen Elizabeth that the English learnt the art of making needles.

Of what are Pins made?

Of brass wire, blanched with tin. They are manufactured in England, France, the United States, and other countries. Though there is scarcely any commodity cheaper than pins, there is no other which passes through the hands of a greater number of workmen; more than twenty persons being successively employed in the manufacture of each, from the drawing of the brass wire to the sticking of the pin in the paper. Pins are supposed to have been made in England about 1543, or even earlier. Before this art was invented, the ladies made use of wooden skewers.

Blanched, whitened.

Of what is Paper made?

Of linen and cotton rags beaten to a pulp in water; also from straw, wood, and many plants.

What materials were used for writing, before the invention of Paper?

Various were the materials on which mankind in different ages and countries contrived to write: stones, bricks, the leaves of herbs and trees, and their rinds or barks; tablets of wood, wax, and ivory; plates of lead, silk, linen rolls, &c. At length the Egyptian paper made of the papyrus, was invented; then parchment; and lastly, paper manufactured of cotton or linen [58]rags. There are few sorts of plants which have not at some time been used for paper and books. In Ceylon, for instance, the leaves of the talipot; in India, the leaves of the palm (with which they commonly covered their houses,) were used for books. In the East Indies, the leaves of the plantain tree, dried in the sun, were used for the same purpose. In China, paper is made of the inner bark of the mulberry, the bamboo, the elm, the cotton, and other trees.

What is Papyrus?

A large rush, chiefly growing in Egypt, on the banks of the Nile. The ancient Egyptians made sails, ropes, mats, blankets, and canvas, of the stalks and fibres of the papyrus. Their priests also wore shoes made of it; and even sugar was extracted from this plant. Moses, the deliverer raised by God to rescue the Israelites from the bondage of Egypt, was exposed to the Nile in a basket of papyrus. The plant is now, however, exceedingly scarce.

Where was the first Paper Mill erected in England?

At Dartford, by a German named Spilman, in 1588. The only sort made, however, was the coarse brown; and it was not till 1690, when the French protestant refugees settled in England, that their own paper-makers began to make white writing and printing paper. The manufacture has been brought to great perfection, both for beauty and substance, in England and the United States.

Protestant, a name given in Germany to those who adhered to the doctrines of the apostate monk, Martin Luther, because they protested against a decree of Charles V. and applied to a general council.

Refugee, from refuge, a place of safety from danger; an asylum. Here it more particularly means those French Protestants who quit their homes and sought other countries, after the revocation of the Edict of Nantes, which deprived them of their religious liberty.

THE DOME OF PISA, ITALY; WITH THE FAMOUS LEANING TOWER, IN THE DISTANCE.

Is it known to whom we are indebted for the invention of Linen Paper?

Not exactly. It has long been disputed among the learned[59] when, and by whom, it was invented; some authors say it was discovered by the Germans, others by the Italians; others ascribe it to some refugee Greeks at Basil, who took the idea from the making of cotton paper in their own country; some, that the Arabs first introduced it into Europe. Perhaps the Chinese have the best title to the invention, inasmuch as they have for many ages made paper, and in some provinces of the same materials as are now used by us in its manufacture.

In what place was the art of Printing first practised?

Who were the inventors of Printing, in what city, and in what year it was begun, has long been a subject of great dispute. Mentz, Harlem, and Strasburg, cities of Germany, all lay claim to the invention, but Mentz seems to have the best title to it.

What was the first Book that was printed from metal types?

A copy of the Holy Scriptures, which made its appearance between the years 1450 and 1452.

Who introduced Printing into England?

William Caxton, a merchant of London, who had acquired a knowledge of it in his travels abroad.

Of what does Printing consist?

Of the art of taking impressions with ink, from movable characters and figures made of metal, &c., upon paper or parchment.

What is Parchment?

Sheep or goat's skin, prepared after a peculiar manner, which renders it proper for several uses, especially for writing on, and for the covering of books. The ancients seem to have used the skins of animals as a writing material, from a remote period.

From what is the word Parchment taken?

From Pergamena, the ancient name of this manufacture, which it is said to have taken from the country of Pergamus; and to Eumenes, king of that country, its invention is usually ascribed, though in reality, that prince appears to have been the improver, rather than the inventor of parchment; since [60]some accounts refer its invention to a still earlier period of time. Herodotus, an ancient Greek historian, who lived about 450 years before Christ, relates that the ancient Ionians made use of sheep and goat-skins in writing, many ages before the time of Eumenes; the Persians of old, too, wrote all their records on skins, and probably such skins were prepared and dressed for that purpose, after a manner not unlike our parchments, though not so artificially.

Who were the Ionians?

The inhabitants of Ionia, an ancient country in the western part of Asia Minor.

In what manner is Parchment now prepared?

The sheep-skins are smeared over with lime[4] on the fleshy side, folded, laid in heaps, and thus left for some days; they are next stretched very tight on wooden frames, after having been washed, drained, and half dried. The flesh is then carefully taken off with iron instruments constructed on purpose, and the skin cleansed from the remaining hairs that adhere to it. After having gone through several operations till it is perfectly clean and smooth, it is fit for writing upon.

[4] See Chapter XVI., article Lime.

What are the uses of Parchment?

Parchment is of great use for writings which are to be preserved, on account of its great durability; the writing on it remaining perfect for a great number of years. It is also used for the binding of books, and various other purposes.

What is Vellum?

A finer sort of parchment than the former, but prepared in the same manner, except that it is not passed through the lime-pit. It is made of the skins of very young calves: there is also a still finer sort made of the skins of sucking lambs, or kids; this is

called *virgin* parchment, and is very thin, fine, and white, and is used for fancy-work, such as ladies' fans, &c.

[61]

CHAPTER VIII.

CAPERS, ALMONDS, ORANGES, LEMONS, CITRONS, LIMES, OLIVES, OILS, MELONS, TAMARINDS, AND DATES.

What are Capers?

The full-grown flower-buds of the Caper Tree, a small shrub, generally found growing out of the fissures of rocks, or among rubbish, on old walls and ruins, giving them a gay appearance with its large white flowers. It is a native of Italy: it is also common in the south of France, where it is much cultivated.

How are they prepared, and for what are they used?

They are gathered, and dried in the shade; then infused in vinegar, to which salt is added; after which they are put in barrels, to be used as a pickle, chiefly in sauces.

What are frequently substituted for Capers?

The buds of broom pickled in the same manner, or the berries of the nasturtium, an American annual plant, with pungent fruit.

What are Almonds?

The nut of the Almond Tree, a species of the peach, growing in most of the southern parts of Europe; there are two kinds, the bitter and the sweet.

What are their qualities and use?

The sweet almonds are of a soft, grateful taste, and much used by the confectioner in numerous preparations of sweet-meats, cookery, &c. Both sorts yield an oil, and are useful in medicine.

Of what country is the Orange a native?

It is a native of China, India, and most tropical countries; but has long been produced in great perfection in the warmer parts of Europe and America. Oranges are imported in immense quantities every year, from the Azores, Spain, Portugal, [62]Italy, &c. They are brought over in chests and boxes, packed separately in paper to preserve them. The

oranges in common use with us are the bitter or Seville, the China or sweet orange, and those from Florida.

Where are the Azores situated?

In the Atlantic Ocean, about 800 miles west of Portugal. These islands are very productive in wine and fruits.

Where is Seville?

In Spain; it is an ancient and considerable city, the capital of the province of Andalusia. The flowers of the Seville orange are highly odoriferous, and justly esteemed one of the finest perfumes. Its fruit is larger than the China orange, and rather bitter; the yellow rind or peel is warm and aromatic. The juice of oranges is a grateful and wholesome acid.

Odoriferous, sweet-scented, fragrant; having a brisk, agreeable smell which may be perceived at a distance.

Who first introduced the China Orange into Europe?

The Portuguese. It is said that the very tree from which all the European orange trees of this sort were produced, was still preserved some years back, at the house of the Count St. Laurent, in Lisbon. In India, those most esteemed, and which are made presents of as rarities, are no larger than a billiard ball. The Maltese oranges are said by some to be the finest in the world.

Who are the Maltese?

The inhabitants of Malta, an island of the Mediterranean, situated between Africa and Sicily.

Whence are Lemons brought?

The Lemon is a native of Eastern Asia, whence it was brought to Greece, and afterwards to Italy; from Italy it was transplanted to Spain, Portugal, and the South of France, whence lemons are imported in great plenty.

What is the Citron?

The fruit of the Citron Tree, resembling the lemon, but [63]somewhat larger, and having a finer pulp. The citron was also brought originally from the East of Asia, but has since been produced in the warm parts of Europe, like the orange and lemon; Genoa especially is the greatest nursery for them. Its rind is principally brought to this country in a candied state, and is applied by confectioners to various purposes.

Where is Genoa?

A city of Northern Italy, on the Mediterranean, between the rivers Bisagno and Polcevera.

What is the Lime?

The Lime is by some thought to be a species of lemon, by others not; it is a smaller fruit, and in the West Indies is greatly preferred to the lemon. It is cultivated in the South of Europe, the West Indies, and the warm parts of America. The agreeable scent called Bergamot is prepared from the rind of a small species of lime.

What are Olives?

The fruit of the Olive Tree, an evergreen, now common in the woods of France, Spain, and Italy; but in the wild state producing a small fruit of no value; when cultivated, however, (which it is extensively, both for the fruit and the quantity of oil which it yields,) it forms one of the richest productions of Southern Europe. The olive came originally from Asia. Its use is very ancient; it is frequently spoken of in the Bible, both as in a wild and cultivated state. The promised land of the Israelites was "a land of oil, olive, and honey." From the time that the dove returned to Noah in the Ark with an "olive leaf plucked off," in all ages and countries, wherever this tree is known, down to the present day, has an olive-branch been the favorite emblem of peace.

What nation holds the olive in great repute?

This tree was a great favorite with the ancient Greeks, and scarcely an ancient custom existed in which the olive was not in some way associated: at their marriages and festivals, all [64]parts of their dwellings, especially the doors, were ornamented with them, and the same custom prevails at the present day, both in public and private rejoicings. It was also scarcely less a favorite with the Romans, although it was not held in the same sacred light as amongst the Greeks. The olive-branch has likewise been universally considered the emblem of plenty, and as such, is found on the coins of those countries of which it is *not* a native. Two centuries after the foundation of Rome, both Italy and Africa were strangers to this useful plant; it afterwards became naturalized in those countries, and at length arrived in Spain, France, &c. Olive trees sometimes attain a great age.

How are the Olives eaten?

The olives while on the tree are intolerably bitter, without any of that peculiar taste which gains them admittance at the richest tables; to fit them for which they are pickled. Ripe olives are eaten in the Eastern countries, especially amongst the Greeks, as an article of food, particularly in Lent. The oil, which they yield in great quantities, is very highly esteemed; being that chiefly used for salads, &c., in medicine, and in various manufactures.

Lent, a time of fasting; the time from Ash-Wednesday to Easter.

How is the Oil drawn from the Olive?

By presses or mills made for the purpose. The sweetest and best olive oil comes from the South of France, from Naples, Florence, and Lucca; quantities are also brought from Spain and the Ionian Islands.

Where is Naples?

In the South of Italy.

Where are Florence and Lucca situated?

In Italy. Florence is a very ancient, large, and celebrated city, the capital of Italy; Lucca, formerly a republic, belongs now to the kingdom of Italy.

Republic, a state in which the supreme power of government is lodged in representatives chosen by the people, instead of being vested in an emperor or king.

You said that the olive is an Evergreen: to what plant or shrub is the term particularly applied?

To any shrub or tree whose leaves continue fresh and green all the year round, winter and summer, as the laurel, pine, cedar, holly, &c., which do not shed their leaves in autumn as other trees.

Is oil a production confined to the Olive alone?

By no means. Oil is a fatty, inflammable matter, drawn from many vegetable and animal bodies. The oils in common use are of three different kinds. The first are mere *oily* or fatty bodies, extracted either by pressure, or by decoction: of the first kind are those of almonds, nuts, olives, &c.; and of the other, those of different berries, &c., which are procured by boiling the substance in water, which causes the oil to collect on the top.

Decoction, act of boiling—a chemical term.

What are the second and third kinds of Oils?

The second are those drawn from vegetables by common distillation in the alembic, with the aid of water; these contain the *oily* and volatile part of the plant, and are called *essential* oils. The third sort are those produced by distillation, but of a different kind in an open vessel, and without the help of water. They are likewise divided into *vegetable* oils, *animal* oils, and *mineral* oils; which last are those drawn from amber, and a few other substances partaking both of the vegetable and mineral natures, as Petroleum, commonly known as kerosene or coal oil.

Alembic, a chemical vessel used in distilling. It consists of a vessel placed over a fire, containing the substance to be distilled; the upper part, which receives and condenses the steam, is called the head; the beak of this is fitted to a vessel called a receiver.

Volatile, easily escaping, quickly flying off.

Whence is the word Oil derived?

[66]

From the Latin *oleum*, formed from *olea, olive-tree*, the fruit of which abounds in oil.

What immense fish is it that furnishes us with a quantity of *animal* oil?

The Whale, the largest and noblest inhabitant of the waters. It is protected from the cold by a case or coating of blubber, that is, a thick oily fat from which the oil is made; numbers of them are caught for the sake of that. Ambergris, highly prized in perfumery, is a product of the sperm whale.

In what seas are they found?

Chiefly in the Northern Seas: extensive whale fisheries are carried on by the Americans, English, Dutch, &c., and numbers of vessels are sent out for the purpose of taking the fish: they usually sail in the latter end of March, and begin fishing about May. The whale fishery continues generally from that time till the latter end of June or July. There are also other fishes and animals which afford us oils of different kinds, which are used for various purposes in medicine and the arts.

Is the oil called *castor*, which is so much used in medicine, the product of an animal or a plant?

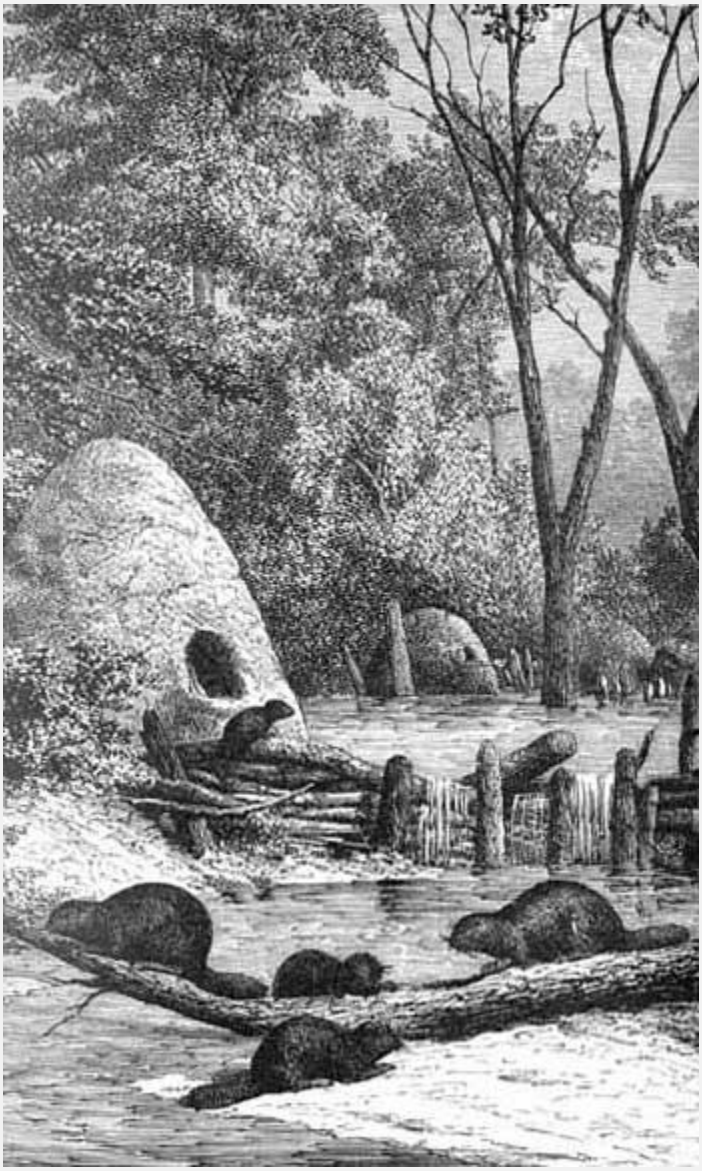
Castor oil is expressed from a West Indian shrub, called Palma Christi; and especially from the ripe seeds, which are full of this oil. It is prepared by collecting these ripe seeds, and freeing them from the husks; then bruising and beating them into a paste; they are next boiled in water, when the oil rising to the surface is skimmed off as it continues to appear. The Castor-oil plant is found growing abundantly in Sumatra, particularly near the sea-shore.

Where is Sumatra situated?

In the Oriental Archipelago, off the south eastern part of the continent of Asia.

In what other countries is this plant found?

In some parts of Africa, Syria, and Egypt. It was anciently cultivated in the two last-mentioned countries in large quantities,[67]the seeds being used for the oil they yielded, which was burnt in lamps.



BEAVERS BUILDING THEIR HUTS.

Is not the Palma Christi much affected by soil and situation?

Greatly so. In some places it attains the stature of a tree, and is not a biennial plant, but endures for many years, as in the warm plains of Irak, Arabia, and some parts of Africa.

Biennial, lasting for the space of two years only.

What are Melons?

A species of the Cucumis, a genus of plants to which the cucumber belongs. There are great varieties of this fruit cultivated in different parts of the world; that sort called the Cantaleup (so named from being cultivated at a place of that name in the neighborhood

of Rome, whither it was brought from Armenia,) is a species of musk-melon; the mature fruit is juicy, and delicately flavored.

Where is Armenia situated?

Armenia is a large country situated in Asiatic Turkey, to the west of the Caspian Sea.

What species of Melon is that which almost makes up for a scarcity of good water in hot countries?

The water-melon, which affords a cool, refreshing juice, and quenches the thirst produced by the excessive heats. It requires a dry, sandy soil, and a warm climate; the pulp of the fruit is remarkably rich and delicious.

What are Tamarinds?

The fruit of the Tamarind Tree, a native of both the Indies, Asia, Africa, &c. It is of a roundish form, and composed of two pods inclosed one within the other, between which is a soft pulpy substance, of a tart but agreeable taste; the inner pod contains the seeds or stones.

Tart, sharp, acid.

For what are they used?

We use them only as medicine; but the Africans, and many [68]of the Oriental nations, with whom they are common, make them into a kind of preserve with sugar, which they eat as a delicacy, and which cools them in the violent heats of their climate.

From what nation was the knowledge of their use in medicine obtained?

From the Arabians.

What does the word Oriental signify?

Belonging to the East; therefore those countries of the globe situated in the East are called Oriental, those in the West, Occidental, from *Oriens*, signifying East, and *Occidens*, West.

What are Dates?

The fruit of the Palm, a beautiful and graceful tree, peculiar to the warmer regions of the globe; the growth of the palm is extremely singular, for although some species attain to the height of the largest forest trees, their structure differs materially from that of a tree, properly so called. The leaves of the young plant arise directly from the surface of the ground, and there is no appearance of any stem for several years; this stem once formed, never increases in size, the growth of the plant being always upward, so that the stem itself is formed by the prior growth of the green portions of the palm.

Structure, the manner of formation.

How often does this tree cast its circle of leaves?

Every year; so that the number of years a palm has existed is known by the scars which are left by their falling off. The palm is an evergreen.

What are the uses of this Tree?

The Palm is of the utmost importance to the inhabitants of the tropical regions; the fruit and sap providing them with food, the fibrous parts with clothing, and the leaves forming the greater part of their slightly-constructed huts; the leaves of some species are formed into fans, hats, and parasols; others are written on, in the same manner that we write on paper; arti[69]ficial flowers are made of the pith of some; the light and supple rattan walking-cane is the slender shoot of another kind; and solid and useful utensils are made of the shell of the cocoa-nut. The fibres of the Date Palm are formed into ropes and twine; a liquor is drawn from the trunk, called palm wine; the trunks of the old trees furnish a hard and durable wood; and even the nuts or stones of the fruit are useful for feeding cattle; a wholesome flour is also made of the fruit, when dried and reduced to powder.

Constructed, put together.

Whence is its name derived?

From the Latin word *palma*, a hand, given to these productions of the vegetable world, from the supposed resemblance of their broad leaves to the human hand. The Date, the fruit of the Date Palm, derives its name from the Greek *dactylus*, a finger, from its mode of growing in clusters spreading out like the fingers of the hand. The Palm sometimes forms impenetrable forests; but more frequently is found in small groups of two or three, or even singly, beside springs and fountains of water, affording a kindly shade to the thirsty traveller.

Impenetrable, not easily penetrated or got through.

From what countries are Dates brought?

From Egypt, Syria, Persia, Africa, and the Indies. Among the Egyptians and Africans, they make a principal article of food. Dates, when ripe, are of a bright coral red, of an oblong form, and possess a sharp biting taste: they are usually gathered in autumn, before being perfectly ripe.

CHAPTER IX.

HATS, STOCKINGS, SHOES, GLOVES, LEATHER, FURS, AND INK.

Of what are Hats made?

Of felt and wool. Dress hats for men's wear, were formerly made of beaver-fur, but the increasing scarcity of this article led to the introduction of silk plush as a substitute, and the result is that beaver is entirely superseded, and plush is used altogether. They possess many advantages over the beaver hat, as they are light, glossy, and durable. Hats are also made of straw, plaited and sewed together.

When did Hats come into general use?

The first mention made of hats is about the time of the Saxons, but they were not worn except by the rich. Hats for men were invented at Paris, by a Swiss, in 1404. About the year 1510, they were first manufactured in London, by Spaniards. Before that time both men and women in England commonly wore close, knitted, woollen caps. They appear to have become more common in the reign of Queen Elizabeth. It is related, that when Charles the Second made his public entry into Rouen, in 1449, he wore a hat lined with red velvet, surmounted with a plume or tuft of feathers; from which entry, or at least during his reign, the use of hats and caps is to be dated; and from that time they took the place of chaperons and hoods, that had been worn before in France.

Where is Rouen?

In the province of Lower Seine, in France; it was formerly the capital of Normandy.

Describe the Castor, or Beaver, and its habits.

The Beaver has a broad, flat tail, covered with scales, serving as a rudder to direct its motion in the water; the toes of its hind feet are furnished with membranes, after the manner of water-fowl; the fore feet supply the place of hands, like those [71]of the squirrel. The Beaver has two kinds of hair, of a light brown color, one long and coarse, the other short and silky. The teeth resemble those of a rat or squirrel, but are longer, and admirably adapted for cutting timber or stripping off the bark from trees.

Membranes, thin, flexible, expanded skins, connecting the toes of water-fowl and amphibious animals, and thus enabling them to swim with greater ease.

Where do Beavers usually fix their habitations?

Their houses are always situated in the water; they are composed of clay, which they make into a kind of mortar with their paws: these huts are of an oval figure, divided into three apartments raised one above the other, and erected on piles driven into the mud. Each beaver has his peculiar cell assigned him, the floor of which he strews with leaves

or small branches of the pine tree. The whole building is generally capable of containing eight or ten inhabitants.

On what does the Beaver feed?

Its food consists of fruit and plants; and in winter, of the wood of the ash and other trees. The hunters and trappers in America formerly killed vast numbers for their skins, which were in great demand, as they were used in making hats, but as the only use they are now put to is for trimming, and for men's gloves and collars, the demand has fallen off.

Of what are stockings made?

Of cotton, silk, or wool, woven or knitted. Anciently, the only stockings in use were made of cloth, or stuff sewed together; but since the invention of knitting and weaving stockings of silk, &c., the use of cloth has been discontinued.

From what country is it supposed that the invention of silk knitted stockings originally came?

From Spain, in 1589. The art of weaving stockings in a frame was invented by William Lee, M.A., of St. John's College, Cambridge, England.

Explain the signification of M.A.

Master of Arts, a degree of honor conferred by the Universities.

What are Shoes?

A covering for the foot, now usually made of leather. In different ages and countries, shoes have been made of various materials, as raw skins, rushes, broom, paper, silk, wool, iron, silver, and gold.

What nation wore Shoes made of the bark of the papyrus?

The Egyptians. The Turks always take off their shoes, and leave them at the door, when they enter Mosques or dwelling-houses. The same custom also prevails in other Eastern nations.

What is a Mosque?

A Mahomedan church or temple.

What is meant by Mahomedan?

Belonging to the religion of Mahomed, the warrior and prophet of Arabia and Turkey, who was its founder. He was born at Mecca, a city of Arabia, in 571; and died in 631, at Medina, a city situated between Arabia Felix and Arabia Deserta. His creed maintains

that there is but one God, and that Mahomed is his Prophet; it enjoins the observance of prayers, washings, almsgiving, fasting, sobriety, pilgrimage to Mecca, &c.

What do the appellations of Felix and Deserta signify?

Arabia, a country of Asia, lying on the borders of the Red Sea, is divided into Petræa, Deserta, and Felix; Petræa, signifying the Stony; Deserta, the Desert; and Felix, the fortunate or fruitful.

What is Leather?

The skins of various animals, as oxen, cows, calves, &c., dressed and prepared for use.

How is the Leather prepared?

By tanning; that is, steeping the skins in an infusion of tan, by which they are rendered firm, durable, and, in a great degree, impervious to water.

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Infusion, a liquor made by steeping anything in water, or other liquids, without boiling.

What is Tan?

The bark of the oak-tree, &c., ground by a mill into a coarse powder.

What is Lime?[5]

A white, soft, friable, earthy substance, prepared from marble, chalk, and other lime-stones, or from shells, by burning in a kiln.

[5] For a further account of it, see Chapters XIII. & XVI.

Friable, easily powdered.

For what is it used?

Its greatest use is in the composition of mortar for building; it is also much used by tanners, skinners, &c., in the preparation of leather; by soap-boilers in the manufacture of soap; and by sugar-bakers for refining sugar.

What is a Kiln?

A fabric of brick or stone, formed for admitting heat in order to dry or burn materials placed in it.

Of what are Gloves made?

Of leather, silk, thread, cotton, worsted, &c.

What skins are generally used for Gloves?

Those of the chamois, kid, lamb, dog, doe, and many other animals.

What are Furs, and how are they prepared?

Furs are the skins of wild animals, dressed with the hair on, and used as apparel, either for warmth, ornament, or distinction of rank or dignity.

Name a few of the principal furs in use.

The fur of the ermine, an animal inhabiting the cold regions of Europe and America, is highly valued, and much used for ornamental purposes. In summer, the upper part of the body is of a yellowish-brown color; the under parts white, slightly tinged with yellow. It is then called a *stoat*. In winter, the [74]fur is closer and finer, and is of a snowy white color; the tip of the tail is black throughout the year. In Europe the fur is much used for ornamenting the state robes of sovereigns and nobles. The sable is another animal much prized for its rich fur; it is a native of Northern Europe and America. The skins of the marten, found in North America, as well as in Northern Asia and the mountains of Kamtschatka; and also of the bear, fox, raccoon, badger, lynx, musk-rat, rabbit, hare, and squirrel, which are all procured in North America, are valuable. One of the most valuable descriptions of fur is that of the seal.

How is it procured?

By hunting the animals, which is the employment both of natives and settlers from other countries; the hunters sell the skins for money, to a company established for the purpose of trading in furs, or more frequently exchange them for clothes, arms, and other articles. The Alaska Commercial Company of San Francisco is granted by the United States Government the exclusive privilege of catching the fur seal.

What is Alum?

A kind of mineral, of a strong, sharp taste. It dissolves both in cold and boiling water, but best in the latter. It is of some use in medicine; a principal ingredient in dyeing and coloring, neither of which can be well performed without it, as it sets and brightens the colors, and prevents them from washing out. It is also extremely useful in many arts and manufactures.

Are there not different sorts of this material?

The principal kinds are native alums: *viz.* those prepared and perfected underground by the spontaneous operations of nature; as the roch, commonly called rock alum, from Rocha, in Syria, whence it is brought.

Spontaneous, unassisted by art.

Orientals, inhabitants of the Eastern parts of the world.

What is Ink?

A liquor used in writing on paper or parchment, made of [75]copperas, galls; and gum arabic[6] mixed together. There are likewise several plants that may serve for the making of ink, as oak-bark, red roses, log-wood, &c. It is also made from an infusion of oak galls and iron filings: there are also many other ways, as well as materials, employed in the making of this useful article. Ink is the name applied to all liquids used in writing, of whatever color they may be, as red, blue, &c., though black is the most used for common purposes. The ink of the ancients seems to have been of a thick, oily nature, unlike the modern ink; it consisted of nothing more than a species of soot, or ivory black, mixed with one fourth of gum.

[6] See Chapter XI.

What is Copperas?

A kind of vitriol. Copperas is the name given to green vitriol, which is a preparation from iron. The blue vitriol is a sulphate of copper, and the white vitriol a sulphate of zinc.

For what is Vitriol used?

In the making of glass, to color it; in many arts and manufactures; and in medicine.

What are Galls?

Excrescences formed on a kind of oak tree in certain warm climates; perforations are made by an insect into the bark of the tree, whence issues a liquid which hardens by exposure. They are used in dyeing, making ink, and other compositions. There are two sorts of oak galls in our shops, brought from the Levant, and the southern parts of Europe.

What does the word Levant signify?

A country to the eastward. It is applied to the countries of Turkey, Greece, Asia Minor, Syria, Egypt, &c., which are washed by the eastern part of the Mediterranean.

Is the Ink used in Printing the same as writing Ink?

No; it is more of the nature of paint, being thicker and more glutinous: it chiefly consists of a mixture of oil and lamp[76]black, or some other ingredient, according to the color required; and is remarkable for the ease with which it adheres to paper that is moistened.

Glutinous, gummy, resembling glue.

What is Indian, or Chinese Ink?

An admirable composition, not liquid like our ink, but solid, and made into cakes somewhat like the mineral colors we use in painting. It is made into all sorts of figures, usually long, and about an inch thick; sometimes gilt with the figures of birds, flowers, &c. To use this ink, it must be rubbed with water, on stone or earthenware, till it produces a beautiful, liquid, shining black. It is used in drawing, &c., and is brought from China. It is composed of lamp-black and size, or animal glue, or gum, to which perfumes and other substances are sometimes added.

CHAPTER X.

ASBESTUS, SALT, COAL, IRON, COPPER, BRASS, ZINC, AND LAPIS CALAMINARIS.

What is the name of the remarkable stone of which a cloth has been made, that resists the action of fire?

The Asbestus, a mineral substance of a whitish or silver color. There are several species of this mineral, which are distinguished by different names, according to the appearance of each, as fibrous asbestus, hard asbestus, and woody asbestus; it is the fibrous sort which is most noted for its uses in the arts. It is usually found inclosed within very hard stones; sometimes growing on their outside, and sometimes detached from them.

Fibrous, full of fibres or threads.

What are its qualities?

It is insipid; will not dissolve in water; and exposed to the fire, it neither consumes nor calcines. The industry of mankind has found a method of working upon this untoward mineral and employing it in making cloth and paper; the process is, however, difficult.

Insipid, without taste.

Was not this curious mineral better known to the ancients than it is at present?

The linen made from it was highly esteemed by them; it was not only better known, but more common, than among us, being equally valuable with the richest pearls; but the superiority of all other cloths to this in every respect, except the resistance to fire, has caused incombustible cloth to be regarded in modern times merely as a curiosity, but it is still employed in chemical preparations.

Incombustible, remaining undestroyed in fire.

To what use did they put it?

In royal funerals, it formed the shroud to wrap the body in that its ashes might be prevented from mingling with the wood, &c., that composed the pile. Some of the ancients made themselves clothes of it, particularly the Brahmins among the Hindoos; it formed wicks for their perpetual lamps; thread, ropes, nets, and paper were also made of it. Pliny, the Roman naturalist, says he has seen napkins of asbestus taken soiled from the table after a feast, which were thrown into the fire, and by that means better scoured than if they had been washed with water.

Naturalist, a person who studies nature, especially in what relates to minerals, vegetables, and animals.

Brahmins, Hindoo priests.

Where is the Asbestus found?

This mineral is found in the greatest quantity in the silver mines of Saxony; at Bleyburg, in Carinthia; in Sweden, Corsica, and sometimes in France, England, and the United States; also in Tartary and Siberia.

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What method is used in preparing the Asbestus?

The stone is laid in warm water to soak, then opened and divided by the hands, that the earthy matter may be washed out. This washing is several times repeated, and the flax-like filaments collected and dried; these are easily spun with the addition of flax. The cloth when woven is best preserved by oil from breaking or wasting; on exposure to the fire, the flax and the oil burn out, and the cloth remains of a pure white. The shorter threads, which separate on washing the stone, may be made into paper in the usual manner.

What is Salt?

A saline crystallization of a sharp, pungent taste, and cleansing quality, used to season flesh, fish, butter, &c., and other things that are to be kept. It is distinguished, with reference to the general sources from which it is most plentifully derived, into three different sorts, namely, fossil, or rock salt; sea, or marine salt; and spring salt, or that drawn from briny springs and wells.

Marine, belonging to the sea.

Saline, consisting of salt.

Briny, consisting of brine; which means water tasting of salt; it is used to signify the waters of the sea, or any salt water.

What is Fossil or Rock Salt?

That which is found in large beds in the bowels of the earth, and which has not undergone any artificial preparation; it is sometimes colorless, but more frequently red, yellow, or blue, and mixed with earthy impurities; this salt was entirely unknown to the ancients, who by rock salt meant that which adheres to the rocks above high-water mark, being lodged there by the spray of the sea, which is evaporated by the heat of the sun; this is the purest salt, and is to be found on the rocks of Sicily, and several islands of the West Indies.

Artificial, produced by art, and the labor of man.

Evaporated, converted into vapor and dissipated.

What is Marine Salt?

That which is made from sea-water, concentrated by repeated evaporations, and at length crystallized.

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What is Spring Salt?

That salt which is not made from sea-water, but from the water of salt wells or springs; large quantities of this salt are made in the United States, in some parts of which saline springs are numerous.

In what manner is it obtained?

The means employed for extracting the salt from the water vary according to circumstances. In hot countries, the water is merely exposed to the action of the sun, until the water is evaporated; the salt procured in this manner is considered the best.

What method is usually employed in countries where the sun's heat is not sufficiently powerful?

In climates where the rays of the sun do not afford sufficient heat, the water, which has been partly evaporated in large shallow reservoirs formed in the earth, called salt-pans, is poured into enormous coppers and boiled for four or five hours: when the contents of the copper are wasted to half the quantity, the liquid begins to be crystallized; the vessel is again filled up, and the brine again boiled and purified: this is repeated three or four times. After the last purifying the fire is kept very low for twelve or fourteen hours, and when the moisture is nearly evaporated the salt is removed, and, after the remaining brine has drained off, is placed in the store-houses.

In what countries is Salt generally found?

This substance, so necessary to the comfort of mankind, is widely distributed over the face of the earth, and nothing, except, perhaps, the air we breathe, is more easily placed within our reach. The ocean is an exhaustless store-house of this valuable article. Those nations of the earth which are placed at a distance from the sea, find themselves provided with magazines of salt, either in solid masses, or dissolved in the waters of inland lakes, or issuing from the solid rocks in springs of brine. At Salina, Syracuse, and other places in Onondaga Co., [80]New York, salt springs are remarkably abundant, and yield annually several millions of bushels; immense quantities are also obtained from the salt-wells on the Great and Little Kanawha, and other places in Western Virginia; it is also extensively manufactured in the western part of Pennsylvania, and throughout the Western States.

Name the countries most noted for mines of Salt.

Poland, Upper Hungary, and the mountains of Catalonia, have extensive salt mines; those in the village of Wieliczca, in Poland, about five leagues from Cracow, are of a surprising depth and size. In the interior of Hindostan, there is a remarkable salt lake; and in several parts of the globe there are spots of ground impregnated entirely with this substance: an island of the East Indies contains a singular kind of fossil, or native dry salt; the soil there is in general very fruitful, but in certain parts of the island, there are spots of ground entirely barren, without the appearance of anything vegetable upon them; these spots taste very much of salt, and abound with it in such quantities, as to supply not only the whole island, but the greater part of the adjacent continent. In Utah Territory, especially in the neighborhood of the Mormon city, at the Great Salt Lake, are found extensive plains thus impregnated with salt, which is procured in great abundance.

Fossil, the remains of minerals or shells dug from the earth.

Impregnated, filled, saturated.

Catalonia, a considerable province of Spain, situated to the north-east.

Adjacent, adjoining, lying near, or contiguous.

To what use did the ancient inhabitants of Africa and Arabia put this substance?

The large slabs of rock salt, with which their country abounds, were employed by them instead of stones, in building their dwellings, the pieces being easily cemented together by sprinkling the joints with water, which, melting the parts of the two surfaces that opposed each other, formed the whole, when dry, into one solid block.

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Does Rock Salt undergo any preparation before it is used?

Yes; when taken from the earth it is dissolved in cold water, and afterwards drawn off into salt-pans, and refined in the same manner as the sea salt.

What is Coal?

A hard, black, sulphurous and inflammable substance, dug out of the earth, serving in many countries as fuel. It is common in most of the countries of Europe and America. In some parts of the United States, it is found in beds having an area of several thousand square miles.

From what is Coal supposed to have originated?

Its origin is supposed to be derived from gigantic trees which flourished in the swamps and forests of the primeval earth. These having been torn away from their native bed, by storms and inundations, were transported into some adjacent lake, river, or sea. Here they floated on the waters until, saturated with them, they sank to the bottom, and being buried in the lower soil of adjacent lands, became transformed into a new state among the members of the mineral kingdom. A long interment followed, during which a course of chemical changes, and new combinations of their vegetable elements, converted them to the mineral condition of coal.

Primeval, original, existing before the flood.

Gigantic, extremely large, greater than the usual size.

Interment, burial under the ground.

Elements, the several parts or principles of which bodies are composed.

What is a Coal Mine?

A subterraneous excavation, from which coal is obtained.

Do the terms Coal and Charcoal signify the same substance?

No; Charcoal is an artificial fuel, made in imitation of coal, by burning wood covered with earth so as partially to exclude the air. It is used for various purposes, as the making of gunpowder,[7] polishing brass and copper, &c., and when a clear and[82] bright fire is required, as it burns with little or no smoke; it is dangerous, however, for one to remain many hours in a close room with a charcoal fire, as the fumes it throws out are hurtful, and would destroy life. Charcoal, in fact, is the coaly residuum of any vegetables burnt in close vessels; but the common charcoal is that prepared from wood, and is generally black, very brittle, light, and destitute of taste or smell. It is a powerful antiseptic, unalterable and indestructible.

[7] See Chapter XII.

Residuum, the remaining part, that which is left.

Antiseptic, that which prevents putrefaction.

What is Iron?

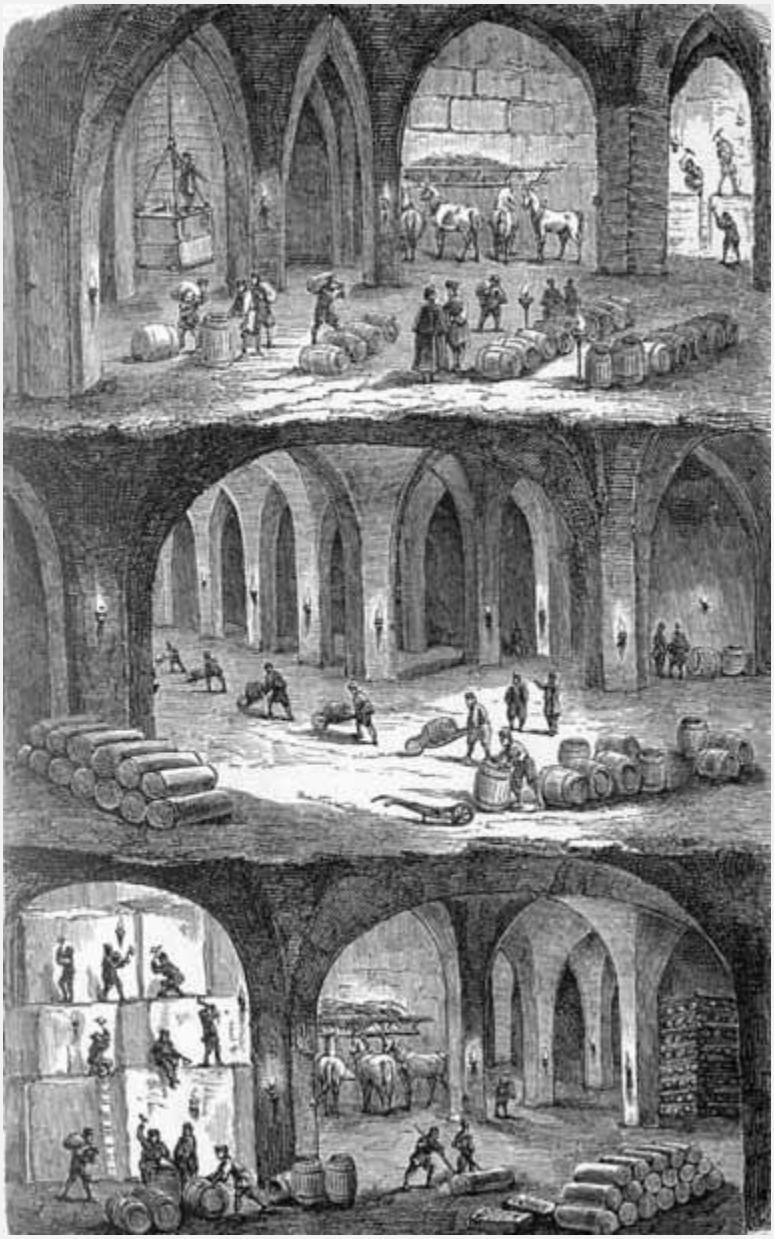
One of the most useful and abundant metals; being found in all mineral earths, and stones; in plants, and animal fluids; and is the chief cause of the varieties of color in all. Iron is found in great masses, in various states, in the bowels of the earth; it is usually, however, compounded with stone, from which it is separated by the action of fire. In some parts of the world, whole mountains are formed of iron; among these may be mentioned the Pilot Knob and the Iron Mountain, in Missouri, being unsurpassed by anything of the kind found elsewhere.

What are its characteristics?

It is hard, fusible, not very malleable, but extremely ductile, and very tenacious; it is of a greyish color, and nearly eight times heavier than water. Without iron, society could make no progress in the cultivation of the ground, in mechanical arts or trades, in architecture or navigation; it is therefore of the greatest use to man. Iron tools have been used in all European countries as long as their histories have existed; this metal appears likewise to have been known and used by the inhabitants of the world in the earliest ages, being frequently mentioned in the Holy Scriptures. In the fourth chapter of Genesis, Tubalcain is spoken of as "a hammerer and artificer in every work of brass and iron," and thus their existence was evidently known at that early period of the world.

Artificer, one who works or makes.

Fusible, capable of being melted by fire.



THE SALT MINES OF WIELICZCA.

What do you mean by Metals?

Useful substances dug from the bowels of the earth, being sometimes found pure, but mostly combined with other matter. They are distinguished by their weight, tenacity, hardness, opacity, color, and peculiar lustre, known as the metallic lustre; they are fusible by heat, and good conductors of heat and electricity; many of them are malleable, and some extremely ductile. Those which were first known are gold, silver, iron, copper, mercury, lead, and tin.

Tenacity, the firmness with which one part adheres to another.

Opacity, want of transparency or clearness.

What are Metals called in their natural state?

Ores; so named because the metal contained in them is either mixed with other metals, or with mineral earths, from which they are separated and purified by various means: such as washing, roasting, &c., but the method is always regulated by the nature of the ore.

What is Copper?

A hard, heavy, ductile metal, found native, and in many ores; of these the most important is *copper pyrites*, which is a sulphuret of copper. Next to gold, silver, and platinum, copper is the most malleable and ductile of metals; it may be drawn into wires as fine as hair, or beaten into leaves as thin as those of silver. The rust of copper is very poisonous. Copper, mixed with a certain quantity of tin, forms bell-metal. With a smaller proportion, it forms bronze, a substance used in sculpture for casting figures and statues. It is an abundant metal, and is found in various parts of the world. Native oxides of copper are found in Cornwall, Siberia, and in North and South America.

Oxide, a substance combined with Oxygen,[8] in a proportion not sufficient to produce acidity.

Sulphuret, a combination of sulphur with a base.

[8] See Chapter XIII., article Oxygen.

What are the uses of Copper?

They are too various to be enumerated. In sheets it is much used to sheathe the bottoms of ships, for boilers, and other utensils. Copper coin was the only money used by the Romans till the 485th year of their city, when silver began to be coined. In Sweden, houses are covered with this metal.

What is a Mine?

A cavity under ground, formed for the purpose of obtaining metals, &c.; mines are often very deep and extensive. The descent into them is by a pit, called a shaft; the clues by which mines are discovered, are, mineral springs, the discoloration of vegetables, the appearance of pieces of ore, &c.

Clues, signs or means by which things hidden are brought to light.

What is Brass?

A factitious metal, consisting of copper and zinc. Brass is lighter and harder than pure copper, and less subject to rust; owing to these properties, together with its beautiful color, it is extremely useful in the manufacture of many utensils.

Factitious, made by art, not found in a natural state.

What is Zinc?

A metal of a brilliant bluish white color. Its name was unknown to the ancient Greeks and Arabians. It is mixed with other substances in the ore, from which it is obtained by smelting in the furnace. It has never yet been found native or pure.

For what is Zinc used?

From its readiness to dissolve in all acids, and unite with other metals, it is used in alloy with them in the composition of brass, &c. Thin sheets of zinc are also used to cover roofs of houses, and in the manufacture of various household utensils.

What is Lapis Calaminaris?

Lapis Calaminaris, or calamine stone, is a native carbonate of zinc, of some use in medicine, but chiefly in founding. It [85]is, sometimes brownish, as that found in Germany and England, or red, as that of France. It is dug out of mines, usually in small pieces; generally out of those of lead. Calamine is mostly found in barren, rocky soils.

Founding, the art of casting metals.

CHAPTER XI.

YAMS, MANGOES, BREAD-FRUIT, SHEA OR BUTTER TREE, COW TREE, WATER TREE, LICORICE, MANNA, OPIUM, TOBACCO, AND GUM.

What are Yams?

The roots of a climbing plant growing in tropical climates. The root of the yam is wholesome and well-flavored; nearly as large as a man's leg, and of an irregular form. Yams are much used for food in those countries where they grow; the natives either roast or boil them, and the white people grind them into flour, of which they make bread and puddings. The yam is of a dirty brown color outside, but white and mealy within.

What are Mangoes?

The fruit of the Mango Tree, a native of India and the south-western parts of Asia; it also grows abundantly in the West Indies and Brazil. It was introduced into Jamaica in 1782; where it attains the height of thirty or forty feet, with thick and wide-extended branches. The varieties of the mango are very numerous,—upwards of eighty are cultivated; and the quality of these varies according to the countries and situations in which they grow. The mangoes of Asia are said to be much better than those of America.

Describe the appearance of the Mango Tree.

The flowers of this tree are small and whitish, formed in [86]pyramidal clusters. The fruit has some resemblance to a short thick cucumber, about the size of a goose's egg; its taste is delicious and cooling; it has a stone in the centre, like that of a peach. At first this fruit is of a fine green color, and some varieties continue so, while others change to a fine golden or orange color. The mango tree is an evergreen, bearing fruit once or twice a year, from six or seven years old to a hundred.

Pyramidal, resembling a pyramid.

How is this fruit eaten?

When ripe, it is eaten by the natives either in its natural state, or bruised in wine. It is brought to us either candied or pickled, as the ripe fruit is very perishable; in the latter case, they are opened with a knife, and the middle filled up with fresh ginger, garlic, mustard, salt, and oil or vinegar. The fruit of the largest variety weighs two pounds or upwards. The several parts of this tree are all applied to some use by the Hindoos: the wood is consecrated to the service of the dead; from the flour of the dried kernels different kinds of food are prepared; the leaves, flowers, and bark, are medicinal.

Medicinal, fit for medicine, possessing medical properties.

Consecrated, separated from a common to a sacred use.

Is there not a tree which bears a fruit that may be used for bread?

Yes; the Bread-fruit Tree, originally found in the southeastern parts of Asia and the islands of the Pacific Ocean, though introduced into the tropical parts of America. It is one of the most interesting, as well as singular productions of the vegetable kingdom, being no less beautiful than it is useful. This tree is large and shady; its leaves are broad and indented, like those of the fig tree—from twelve to eighteen inches long, rather fleshy, and of a dark green. The fruit, when full-grown, is from six to nine inches round, and of an oval form—when ripe, of a rich, yellow tinge; it generally hangs in clusters of two or three, on a small thick stalk; the pulp is white, partly [87]farinaceous, and partly fibrous, but when ripe, becomes yellow and juicy.

Indented, toothed like the edge of a saw.

Farinaceous, mealy, consisting of meal or flour; from *farina*, flour.

How is the Bread-Fruit eaten?

It is roasted until the outside is of a brown color and crisp; the pulp has then the consistency of bread, which the taste greatly resembles; and thus it forms a nourishing food: it is also prepared in many different ways, besides that just mentioned. The tree produces three, sometimes four crops in a year, and continues bearing for fifty years, so that two or three trees are enough for a man's yearly supply. Its timber, which at first is of a rich yellow, but afterwards assumes the color of mahogany, is used in the building of houses and canoes; the flowers, when dried, serve as tinder; the sap or juice serves for glue; the inner bark is made, by the natives of some of the islands of the Pacific Ocean, into a kind of cloth; and the leaves are useful for many purposes. One species of the bread-fruit, called the Jaca tree, grows chiefly on the mainland of Asia.

Mainland, the continent.

Describe the Jaca Tree.

This kind grows to the same, if not a larger size than the bread-fruit of the islands, but is neither so palatable nor so nutritious; the fruit often weighs thirty pounds, and contains two or three hundred seeds, each four times as large as an almond. December is the time when the fruit ripens; it is then eaten, but not much relished; the seeds are also eaten when roasted. There are also other trees in different parts of the world, mostly of the palm species, which yield bread of a similar kind.

Is there not a tree which produces a substance resembling the Butter which we make from the milk of the cow?

The Shea, or Butter Tree, a native of Africa: it is similar in appearance to the American oak, and the fruit, (from the kernel of which the butter is prepared,) is somewhat like an [88]olive in form. The kernel is inclosed in a sweet pulp, under a thin, green rind.

How is the Butter extracted?

The kernel, being taken out and dried in the sun, is boiled in water; by which process a white, firm, and rich-flavored butter is produced, which will keep for a whole year without salt. The growth and preparation of this commodity is one of the first objects of African industry, and forms a principal article of their trade with one another.

You have given me an account of a useful Butter prepared from a plant; is there not also a tree which can supply the want of a cow?

In South America there is a tree, the juice of which is a nourishing milk; it is called the Cow Tree. This tree is very fine; the leaves are broad, and some of them ten inches long; the fruit is rather fleshy, and contains one or two nuts or kernels. The milk is very

abundant, and is procured by incisions made in the trunk of the tree; it is tolerably thick, and of a glutinous quality, a pleasant taste, and agreeable smell. The negroes and people at work on the farms drink it, dipping into it their bread made of maize.

Glutinous, having the quality of glue,—an adhesive, gummy substance, prepared from the skins of animals: it is used in joining wood, &c., and for many other purposes.

What time of the day is the best for drawing the juice?

Sunrise; the blacks and natives then hasten from all quarters with large bowls to receive the milk; some drink it on the spot, others carry it home to their families.

What island possesses a remarkable substitute for the want of springs of Water?

Ferro, one of the Canary Isles, situated in the Atlantic Ocean. In this island there is no water, except on a part of the beach which is nearly inaccessible; to supply the place of a fountain, Nature has bestowed on the island a particular kind [89]of tree, unknown in other parts of the world. It is of a moderate size, with straight, long, evergreen leaves; on its top a small cloud continually rests, which so drenches the leaves with moisture, that it perpetually distils upon the ground a stream of clear water. To these trees, as to perennial springs, the inhabitants of Ferro repair, and are supplied with abundance of water for themselves and cattle.

Perennial, lasting through the year, perpetual.

What is Licorice?

A plant, the juice of which is squeezed from the roots, and then boiled with sugar, and used as a remedy for coughs, &c. Great quantities are exported from Spain, Italy, &c. The dried root is of great use in medicine, and makes an excellent drink for colds and other affections of the lungs by boiling it with linseed.

What are the Lungs?

The organs of respiration in man and many other animals. There are two of these organs, one on each side of the chest.

Respiration, breathing; the act of inhaling air into the lungs, and again expelling it, by which animal life is supported.

What is Manna?

A sweet, white juice, oozing from the branches and leaves of a kind of ash tree, growing chiefly in the southern parts of Italy, during the heats of summer. When dry, it is very light, easily crumbled, and of a whitish, or pale yellow color, not unlike hardened honey.

Is Manna peculiar to the Ash Tree of Southern Italy?

No. Manna is nothing more than the nutritious juices of the tree, which exude during the summer heats; and what confirms this is, that the very hot summers are always those which are most productive of manna. Several different species of trees produce a kind of manna; the best and most used is, however, that of Calabria, in Italy.

[90]

What are its uses?

It was much esteemed formerly in medicine, but it has now gone nearly into disuse. The peasants of Mount Libanus eat it as others do honey. The Bedouin Arabs consume great quantities, considering it the greatest dainty their country affords. In Mexico, they are said to have a manna which they eat as we do cheese. At Briançon, in France, they collect it from all sorts of trees that grow there, and the inhabitants observe, that such summers as produce the greatest quantities of manna are very fatal to the trees, many of them perishing in the winter.

Is there not another tree which produces Manna?

Yes: the Tamarisk, a tree peculiar to Palestine and parts of Arabia. This remarkable substance is produced by several trees, and in various countries of the East. On Mount Sinai there is a different species of Tamarisk that yields it. It is found on the branches of the tree, and falls on the ground during the heat of the day.

Where is Mount Libanus?

Mount Libanus, or Lebanon, is situated in Asiatic Turkey; it was anciently famous for its large and beautiful cedar trees. The "Cedars of Lebanon" are frequently mentioned in Holy Writ. There are now scarcely any remaining of superior size and antiquity, but they vary from the largest size down to mere saplings; and their numbers seem to increase rather than diminish, there being many young trees springing up.

How is Manna gathered?

From August to September, the Italians collect it in the following manner, *viz.*: by making an incision at the foot of the tree, each day over that of the preceding, about four inches from one another: these cuts, or incisions, are nearly two inches long, and half an inch deep. When the cut is made, the manna directly begins to flow, at first like clear water, but congealing as it flows, it soon becomes firm: this they collect in baskets. Manna has been found to consist of two distinct substances [91]one nearly resembling sugar, the other similar to a gum or mucilage.

What nation was fed with a kind of Manna?

The Children of Israel, when wandering in the desert wilderness, where no food was to be procured, were fed by a miraculous supply of manna, showered down from Heaven

every morning on the ground in such quantities as to afford sufficient food for the whole host.

What is Opium?

A narcotic, gummy, resinous juice, drawn from the head of the white poppy, and afterwards thickened; it is brought over in dark, reddish brown lumps, which, when powdered, become yellow.

Narcotic, producing sleep and drowsiness.

In what countries is it cultivated?

In many parts of Asia, India, and even the southern parts of Europe, whence it is exported into other countries. The Turks, and other Eastern nations, chew it. With us it is chiefly used in medicine. The juice is obtained from incisions made in the seed-vessels of the plant; it is collected in earthen pots, and allowed to become sufficiently hard to be formed into roundish masses of about four pounds weight. In Europe the poppy is cultivated mostly for the seeds. Morphia and laudanum are medicinal preparations of opium.

What is Tobacco?

An herbaceous plant which flourishes in many temperate climates, particularly in North America; it is supposed to have received its name from Tabaco, a province of Mexico; it is cultivated in the West Indies, the Levant, on the coast of Greece, in the Archipelago, Malta, Italy, France, Ceylon, &c. It was not known in Europe till the discovery of America by the Spaniards; and was carried to England about the time of Queen Elizabeth, either by Sir Francis Drake or Sir Walter Raleigh. Tobacco is either taken as snuff, smoked in pipes or in the form [92]of cigars, or chewed in the mouth like opium. There are many different species of this plant, most of them natives of America, some of the Cape of Good Hope and China. Tobacco contains a powerful poison called nicotine.

Herbaceous, like an herb or plant, not a shrub or tree.

What part of the plant is used?

The leaves, which are stripped from the plant, and after being moistened with water, are twisted up into rolls; these are cut up by the tobacconist, and variously prepared for sale, or reduced into a scented powder called snuff.

Who was Sir Francis Drake?

Sir Francis Drake was a distinguished naval officer, who flourished in the reign of Elizabeth. He made his name immortal by a voyage into the South Seas, through the

Straits of Magellan; which, at that time, no Englishman had ever attempted. He died on board his own ship in the West Indies, 1595.

Who was Sir Walter Raleigh?

Sir Walter Raleigh was also an illustrious English navigator and historian, born in 1552. He performed great services for Queen Elizabeth, particularly in the discovery of Virginia, and in the defeat of the Spanish Armada; he lived in honor and prosperity during her reign, but on the accession of James the First, was stripped of his favor at court, unaccountably accused of high treason, tried, and condemned to die; being reprieved, however, he was imprisoned in the Tower of London many years, during which time he devoted himself to writing and study. Receiving, at last, a commission to go and explore the gold mines at Guiana, he embarked; but his design having been betrayed to the Spaniards, he was defeated: and on his return to England, in July, 1618, was arrested and beheaded, (by order of the King, on his former attainder,) October 29; suffering his fate with great magnanimity.

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High Treason, in England, means an offence committed against the sovereign. In the United States it consists in levying war against the government, adhering to its enemies, and giving them aid and comfort.

Reprieved, respited from sentence of death.

Magnanimity, greatness of mind, bravery.

What is Gum?

A mucilaginous juice, exuding from the bark of certain trees or plants, drawn thence by the warmth of the sun in the form of a glutinous matter; and afterwards by the same cause rendered firm and tenacious. There are many different gums, named after the particular tree or plant from which they are produced.

Mucilaginous, consisting of mucilage.

Tenacious, adhering closely.

What is the character of Gum?

Gum is capable of being dissolved in water, and forming with it a viscid transparent fluid; but not in vinous spirits or oil; it burns in the fire to a black coal, without melting or catching fire; and does not dissolve in water at boiling heat. The name of *gum* has been inaccurately given to several species of gum-resins, which consist of resin and various other substances, flowing from many kinds of trees, and becoming hard by exposure to the air. These are soluble in dilute alcohol. Gum is originally a milky liquor, having a greater quantity of water mixed with its oily parts, and for that reason it

dissolves in either water or oil. Another sort is not oily, and therefore dissolves in water only, as gum Arabic, the gum of the cherry-tree, &c.

Viscid, thick, ropy.

Vinous, having the qualities of wine.

Are the last-mentioned sorts properly called Gums?

No, though commonly called gums, they are only dried mucilages, which were nothing else than the mucilaginous lymph issuing from the vessels of the tree, in the same manner as it does from mallows, comfrey, and even from the cucumber; the vessels of which being cut across, yield a lymph which is plainly mucilaginous, and if well dried, at length becomes a kind of gum, or rather, a hardened mucilage.

Lymph, transparent fluid.

What is Gum Arabic?

The juice of a small tree of the Acacia tribe, growing in Egypt, Arabia Petræa, Palestine, and in different parts of America.

Are there other plants or trees which produce Gum, besides those already mentioned?

A great number, though not all commonly in use. The leaves of rhubarb, the common plum, and even the sloe and the laurel, produce a clear, tasteless gum; there are also a number of different gums, brought from foreign countries, of great use in medicine and the arts. Most of the Acacias produce gums, though the quality of all is not equally good.

What is Rhubarb?

A valuable root growing in China, Turkey, and Russian Tartary. Quantities of it are imported from other parts of the world: that from Turkey is esteemed the best. Rhubarb is also cultivated in our gardens, and the stalks of the leaves are often used in tarts; but the root, from the difference of climate, does not possess any medicinal virtue.

CHAPTER XII.

When were Spectacles invented, and who was their inventor?

It is supposed that they were first known about the thirteenth century, and invented by a monk of Pisa, in Italy, named [95]Alexander de Spina. Spectacles are composed of two circular pieces of glass set in a frame.

What are these glasses called?

Lenses. They are either convex or concave, according to the kind of sight requiring them. Old people, and those who can only see things at a distance, from the flatness of the eye, which prevents the rays of light converging so as to meet in the centre, require convex lenses. People who can only distinguish objects when viewed closely, from the eye being too convex, require concave lenses to counteract it by spreading the rays, and thus rendering vision distinct.

Convex, rising outwardly in a circular form; opposite to concave.

Concave, hollow; round, but hollow, as the inner curve of an arch, &c.

Converging, tending to one point from different parts.

Vision, the faculty of seeing.

What is the Mariner's Compass?

A most useful and important instrument, by the aid of which the navigator guides his ship on the sea, and steers his way to the place of his destination. The inventor of the Mariner's Compass is not known, nor the exact time of its introduction; it was employed in Europe in navigation about the middle of the thirteenth century, and has been in use more than five hundred years. The Chinese are said to have been acquainted with it much earlier, but no reliance can be placed on their dates. The power of the loadstone to attract iron was known to the ancient Egyptians, but it was not applied to any practical purpose.

Navigator, one who guides a ship.

Steer, to direct or guide a vessel in its course.

Destination, the place to which a person is bound.

Practical, capable of practice, not merely speculative.

What is the Loadstone?

An ore of iron which possesses the peculiar property of attracting iron, namely, of drawing it in contact with its own mass, and holding it firmly attached by its own power of attraction. A piece of loadstone drawn several times along a needle,[96] or a small piece of iron, converts it into an artificial magnet; if this magnetized needle is carefully balanced, it will turn round of itself, till its end points towards the North. The magnetized needle also possesses the power of attracting iron, and of communicating this power to another piece of iron or steel, similar to that of the loadstone itself.

Contact, touch.

Magnetized, rendered magnetic.

Describe the Mariner's Compass.

The Mariner's Compass consists of a circular box, enclosing a magnetized bar of steel, called the *needle*, carefully balanced on an upright steel pivot, and having that end which points to the North shaped like the head of an arrow; attached to this needle, and turning with it, is a card on which are printed the divisions of North, South. East, and West; called the points of the compass. By simply looking at the position of the needle, the mariner can see the direction in which his vessel is sailing, and regulate his helm accordingly.

Helm, the instrument by which a ship is steered, consisting of a rudder and tiller.

What is a Barometer?

An instrument for measuring the weight of the atmosphere, which enables us to determine the changes of the weather, the height of mountains, &c. It consists of a glass tube hermetically sealed at one end, filled with mercury, and inverted in a basin of mercury; according to the weight of the atmosphere, this mercury rises or falls.

How is the Hermetic seal formed?

By heating the edges of a vessel, till they are just ready to melt, and then twisting them closely together with hot pincers, so that the air may be totally excluded. The word is taken from Hermes, the Greek name for Mercury, the heathen god of arts and learning, and the supposed inventor of chemistry,[9] which is sometimes called the hermetical art; or perhaps from Hermes, an ancient king of Egypt, who was either its inventor, or excelled in it.

[9] See Chapter XVIII., article Chemistry.

What is Mercury?

Quicksilver, or mercury, is a white fluid metal, the heaviest except platina and gold; it readily combines with nearly all other metals, and is used in the manufacture of looking-glasses, barometers, thermometers, &c.; in some of the arts, and in the preparation of several powerful medicines. It is found in California, Hungary, Sweden, Spain, China, and Peru. The quicksilver mine of Guança Velica, in Peru, is one hundred and seventy fathoms in circumference, and four hundred and eighty deep. In this profound abyss are seen streets, squares, and a chapel, where religious worship is performed. The quicksilver mines of Idria, a town of Lower Austria, have continually been wrought for more than 300 years. The vapor which is continually arising from the mercury is very hurtful to the miners, who seldom survive many years.

Abyss, a gulf, a depth without bottom.

In what state is Mercury usually found?

Either native, or in the form of ore; it is often found mixed with silver, but more frequently with sulphur in the form of sulphuret, which is decomposed by distillation. Running mercury is found in globules, in America, and is collected from the clefts of the rocks. Mercury has the appearance of melted silver; it is neither ductile nor malleable in this state; it is a substance so volatile, when heated, that it may be evaporated like water; it is always seen in a fluid state, even in temperate climates, as a very small portion of heat is sufficient to preserve its fluidity. It is used to separate gold and silver from the foreign matter found with those metals. Calomel, a valuable medicine, and vermilion, a color, are both preparations of mercury.

Globules, small particles of matter having the form of a ball or sphere.

What is a Thermometer?

An instrument for measuring temperature. It consists of a fine glass tube, terminated at one end in a bulb, usually filled with mercury, which expands or contracts according to the degree of heat or cold. On the scale of the Fahrenheit thermometer, the freezing point of water is marked 32° and the boiling point at 212°. In both the Centigrade and the Reaumur scales the freezing point is at 0, and the boiling point at 100° in the Centigrade and at 80° in Reaumur's. The invention of this instrument dates from about the close of the sixteenth century; but it is not known by whom it was first brought into use.

Terminated, finished, ended.

When and by whom were Watches and Clocks invented?

Watches were invented about the year 1500, but who was the inventor is disputed. They were, however, of little value as time-keepers, before the application of the spiral spring

as a regulator to the balance; the glory of this excellent invention lies between Dr. Hooke and M. Huygens; the English ascribing it to the former, the Dutch, French, &c., to the latter. Some assert that pocket-watches were first made about 1477, at Nuremberg, in Germany. The most ancient clock of which we possess any certain account, was made in 1634 by Henry de Wycke, a German artist; it was erected in a tower of the palace of Charles V., king of France. The pendulum was applied by Huygens, in 1656.

What is a Pendulum?

A weight so suspended from a fixed point that it may easily swing backward and forward; its oscillations are always performed in equal times, provided the length of the pendulum and the gravity remain the same. It is said that the idea of employing the pendulum for the measurement of time, was first conceived by Galileo, while a young man, upon his observing attentively the regular oscillations of a lamp suspended from the roof of a church in Pisa. It was not, however, till the time of Huygens that a method was devised of continuing its motions, and registering the number of its oscillations.

Oscillation, a swinging backward and forward.

Gravity, the tendency of a body toward the centre of the earth.

Registering, recording.

CHARCOAL BURNING.

GOLD MINERS WASHING ORE.

To whom is the invention of Gunpowder ascribed?

Most authors suppose it was invented by Bartholdus Schwartz, a monk of Goslar, a town of Brunswick, in Germany, about the year 1320; it appears, however, that it was known much earlier in many parts of the world, and that the famous Roger Bacon, who died in 1292, knew its properties; but it is not certain that he was acquainted with its application to fire-arms.

Who was Roger Bacon?

A learned Franciscan, born at Ilchester, England, in 1214. He studied at Oxford, and afterwards became professor at that great University. He was familiar with every branch of human knowledge, but was especially distinguished for his extraordinary proficiency in the natural sciences. To him we owe the invention of the telescope; that of gunpowder is ascribed to him, as stated above, although we have no evidence to show whether he discovered its ingredients himself, or whether he derived the knowledge from some ancient manuscripts. Bacon suffered some from the ignorance of the age in which he lived, many of his experiments being looked upon as magic. He died at Oxford in the year 1294.

What is understood by Magic?

Magic is a term used to signify an unlawful and wicked kind of science, depending, as was pretended, on the assistance of superhuman beings and of departed souls. The term was anciently applied to all kinds of learning, and in particular to the science of the Magi or Wise Men of Persia, from whom it was called magic. *Natural* magic is no more than the application of natural active causes to passive things or subjects, to produce effects apparently supernatural.

Supernatural, beyond the powers of nature; miraculous.

Of what is Gunpowder composed?

Of saltpetre,[10] sulphur, and charcoal, mixed together and powdered; its explosive force when fired, is owing to the instantaneous and abundant liberation of gaseous matter by the intense heat resulting from the action of the combustibles upon the saltpetre. It is not known by whom it was first applied to the purposes of war, but it is certain that it was used early in the fourteenth century. Cannons were used at the battle of Cressy, in 1346; small guns, or muskets, were introduced into the Spanish army in 1521.

[10] See Chapter XIII.

Explosive, bursting out with violence and noise.

Liberation, a setting at liberty.

Is not Gunpowder highly combustible?

So combustible is gunpowder, that a single spark of fire, lighting upon any of it, will cause it to explode with immense force; and instances have occurred, when any store or magazine of it has taken fire, that have been attended with the most fatal effects. It is useful to the miner and engineer as a ready means of overcoming the obstacles which are presented in their search for mineral treasures, and in procuring materials for building. From many passages in the ancient authors, there is reason to suppose that gunpowder, or a composition extremely like it, was known to them; but it does not appear to have been in general use, and the invention of fire-arms is comparatively modern. Dynamite, a recent invention, has a still greater explosive force than gunpowder.

Engineer, one who works or directs an engine.

Obstacles, hinderances, obstructions.

What is Saltpetre?

A bitter kind of salt, called by the ancients nitre, but more commonly among us saltpetre. It is composed of nitric acid and potassa.[11] It is found in earthy substances; sometimes native or pure, in the form of a shapeless salt. Vast quantities [101]are found in several of the marly earths of the East Indies, China, Persia, and also in South America. In India it is found naturally crystallized, and forming thin crusts upon the surface of the earth. It is especially abundant in the United States, being found in immense quantities in the limestone caves in the south-western States.

[11] See Potash, Chapter VII., article Glass.

What do you mean by *Marly*?

Consisting of marl, a kind of earth composed of different proportions of clay and carbonate of lime; it is much used for manure. There are several different-colored marls, each possessing different qualities. The most common are the red and the white, though there are grey, brown, blue, and yellow colored marls.

What is a Telescope?

An optical instrument, which serves for discovering and viewing distant objects, either directly by glasses, or by reflection. The invention of the telescope is one of the noblest and most useful of which modern ages can boast, since by means of this instrument the wonderful motions of the planets and fixed stars, and all the heavenly bodies, are revealed to us. The honor of the invention is much disputed; it is certain, however, that the celebrated Galileo was the first who improved the telescope so as to answer astronomical purposes. The name is formed from two Greek words, one signifying *far*, the other *to observe*.

Optical, relating to Optics, the science of vision.

Astronomical, relating to Astronomy.

Who was Galileo?

A most eminent astronomer and mathematician, born at Florence, in Italy. His inventions and discoveries in Astronomy, Geometry, and Mechanics, contributed much to the advancement of those sciences. He died in 1642.

Astronomer, one versed in Astronomy.

Mathematician, one versed in Mathematics; a science which treats of magnitude and number.

What is Astronomy?[12]

That science which teaches the knowledge of the heavenly bodies, with the nature and causes of their various phenomena.

[12] See Chapter XVIII.

What is Geometry?

An ancient, perfect, and beautiful science, which treats of the relations and properties of lines, surfaces, and solids.

What is meant by Mechanics?

The science which investigates the laws of forces and powers, and their action on bodies, either directly or by machinery. When the term *mechanic* is applied to a *person*, it means one skilled in mechanics, accustomed to manual labor.

Investigate, to search, to inquire into.

Manual, performed by the hand.

What is a Microscope?

An optical instrument, by means of which very minute objects are represented exceedingly large, and viewed very distinctly according to the laws of refraction or reflection. Nothing certain is known respecting the inventor of microscopes, or the exact time of their invention, but that they were first used in Germany, about 1621.

Minute, small, diminutive.

Refraction, a change in the direction of a ray of light, when it passes through transparent substances of different densities.

Reflection, a turning back of a ray of light after striking upon any surface.

What is the Steam Engine?

A machine that derives its moving power from the force of the steam produced from boiling water, which is very great, especially when, as in the steam engine, it is confined within a limited compass: this useful machine is one of the most valuable presents that the arts of life have received from the philosopher, and is of the greatest importance in working mines; supplying cities with water; in working metals; in many mechanical arts; and in navigation. By the aid of steam, vessels [103]are propelled with greater swiftness than those which are wholly dependent on the winds and tides; and thus trade is facilitated, and we are enabled to communicate with distant lands in a much shorter space of time than was formerly consumed. On land, railroads are constructed, on which steam carriages run with astonishing rapidity, so that a journey which by coach and horses formerly required two or more days, may now be performed in four or five hours.

Mechanical, belonging to Mechanics.

To whom are we indebted for its invention?

Its invention is by most writers ascribed to the Marquis of Worcester, an Englishman, about 1663; but it does not appear that the inventor could ever interest the public in favor of this, or his other discoveries. The steam engine of Captain Savery, also an Englishman, is the first of which any definite description has been preserved. It was invented in 1698. Since that period it has been successively improved by various persons, but it is to Mr. Watt and Mr. Boulton, of England, that it is indebted for much of its present state of perfection.

By whom was the Steam Engine first applied to the purposes of Navigation?

By John Fitch, of Pennsylvania. From papers in the historical collections of Pennsylvania, it appears that the first successful experiments were made at Philadelphia, in 1785, three years before the attempts at Falkirk, and on the Clyde, in Scotland. The boat made several trips on the Delaware and Schuylkill rivers, but owing to repeated accidents to her machinery, and the want of funds and competent mechanics for the necessary repairs, she was abandoned. In 1807, Robert Fulton, also of Pennsylvania, made his first experimental trip on the Hudson River, with complete success. To this distinguished and ingenious American justly belongs the honor of having brought navigation by steam to a state of perfection. In 1819, the first steamship crossed the Atlantic from Savannah [104]to Liverpool; and in 1838, a regular communication by steamship was established between Great Britain and the United States. Since that period, ocean navigation by steam-vessels has made rapid progress, and, at the present time, numbers of steamers connect our various seaports with those of other nations, and with each other.

What is the Electro-Magnetic Telegraph?

An instrument, or apparatus, by means of which intelligence is conveyed to any distance with the velocity of lightning. The electric fluid, when an excess has accumulated in one place, always seeks to transfer itself to another, until an equilibrium of its distribution is fully restored. Consequently, when two places are connected by means of a good conductor of electricity, as, for instance, the telegraphic wire; the fluid generated by a galvanic battery, if the communication be rendered complete, instantaneously traverses the whole extent of the wire, and charges, at the distant station, an electro-magnet; this attracts one end of a lever, and draws it downward, while the other extremity is thrown up, and, by means of a style, marks a slip of paper, which is steadily wound off from a roller by the aid of clock-work. If the communication is immediately broken, only one wave of electricity passes over, and a *dot* is made upon the paper; if kept up, a *line* is marked. These dots and lines are made to represent the letters of the alphabet, so that an operator employed for the purpose can easily read the message which is transmitted.—The Electro-Magnetic Telegraph was first introduced upon a line between Baltimore and Washington, by Professor Morse, in 1844; at the present time, it is in successful operation between nearly all the important cities and towns of the United States and of Europe.

An *Electro-Magnet* is a piece of soft iron, rendered temporarily magnetic by being placed within a coil of wire through which a current of electricity is passing.

CHAPTER XIII.

SOAP, CANDLES, TALLOW TREE, SPERMACETI, WAX, MAHOGANY, INDIAN RUBBER OR CAOUTCHOUC, SPONGE, CORAL, LIME, CARBON, OXYGEN, NITROGEN, GAS, HYDROGEN, CHALK, AND MARBLE.

Of what is Soap composed?

Of soda or potash, and various oily substances; it is so useful for domestic and other purposes, that it may be regarded as one of the necessaries of life; immense quantities of it are consumed in all civilized countries. Soft soap is generally made of a lye of wood-ashes and quicklime, boiled up with tallow or oil; common household soap of soda and tallow, or of potash and tallow; when potash is used, a large portion of common salt, which contains soda, is added to harden it. The finest white soaps are made of olive oil and a lye consisting of soda and quicklime; perfumes are sometimes added, or various coloring matters stirred in to give the soap a variegated appearance.

The ancient Greeks and Hebrews appear to have been acquainted with the art of making soap, or a composition very similar to it; and also the ancient Gauls and Germans. A soap-boiler's shop, with soap in it, was found in the city of Pompeii, in Italy, which was overwhelmed by an eruption of Mount Vesuvius, A.D. 79.

What is Soda?

Soda, or barilla, is obtained from the ashes of marine plants, and by the decomposition of common salt; its great depository is the ocean, soda being the basis of salt. The marine plants from which the soda is obtained, are endowed with the property of decomposing the sea-salt which they imbibe, and of absorbing the soda which it contains. It is found native in Egypt, and is there called *natron*; a name similar to that which it bore among the Jews and Greeks.

Depository, store-house, place where anything is lodged.

Imbibe, to drink in, to absorb.

Of what are Candles made?

Of Tallow, which means animal fat melted and clarified, that is, cleansed or purified from filth. Tallow is procured from many animals, but the most esteemed, and the most used, is that made from oxen, sheep, swine, goats, deer, bears, &c.; some of which tallows or fats are used in medicine, some in making soap, and dressing leather; others in the manufacture of candles, &c. For the last-mentioned article, that of sheep and oxen is most used; candles of a better sort are likewise made of wax and spermaceti. Candles are kept burning by means of a wick of cotton or rush, placed in the centre of the tallow, which is moulded into a cylindrical form.

Cylindrical, having the form of a cylinder.

Is there not a tree which yields a vegetable Tallow?

Yes; China possesses a tree producing a substance like our tallow, of which the Chinese make their candles; this tallow is extracted from the stone of the fruit, the tallow being a white pulp which surrounds it. In America, likewise, there is a shrub, a native of the temperate parts, especially towards the sea-side, the seeds of which contain a waxy substance used for the same purpose, and which is extracted by boiling; this shrub is a species of myrtle, and does not attain to any great size.

Extracted, drawn from.

What is Spermaceti?

A whitish, flaky, unctuous substance, prepared from an oil of the same name, drawn from a particular kind of whale, distinguished from the common whale by having teeth, and a hunch on its back.

Flaky, having the nature of flakes.

What is Wax?

A soft, yellow, concrete matter, collected from vegetables by [107]the bee, of which this industrious and useful insect constructs its cell. Wax forms a considerable article of trade; it is of two kinds, the yellow and the white; the yellow is the native wax as it is taken from the hive, and the white is the same washed, purified, and exposed to the air.

Concrete, grown together, solid.

What Tree produces the beautiful and well-known wood so much used in making the various articles of household furniture?

The Mahogany Tree, growing in America, and the East and West Indies; it frequently grows in the crevices of rocks, and other places of the same description. This wood was not used for making furniture till near the end of the seventeenth century. A London physician had a brother, the captain of a West India ship, who, on his return to England, having on board several logs of mahogany for the purpose of ballast, made him a present of the wood, he being engaged in a building project; his carpenter, however, threw it aside, observing that it was too hard to be wrought. Some time after, the lady of the physician being in want of a box to hold candles, the cabinet-maker was directed to make it of this wood; he also made the same objection, and declared that it spoiled his tools. Being urged, however, to make another trial, he at length succeeded; when the box was polished, the beautiful color of the wood was so novel, that it became an object of great curiosity. Before this time, mahogany had been used partially in the West Indies for ship-building, but this new discovery of its beauty soon brought it into general use for making furniture.

Crevice, a rent, a crack.

Ballast, the heavy matter placed in the hold of a vessel to keep it steady.

What is India Rubber or Caoutchouc?

An elastic, resinous substance, produced from a tree, growing abundantly at Cayenne, Quito, and other parts of South America; and also in some parts of the Indies. The tree which [108]produces it is large, straight, and about sixty feet high. There is, however, a small species found in Sumatra and Java, and some of the neighboring islands.

How is the Caoutchouc obtained from the Tree?

By making incisions in the trunk of the tree, from which the fluid resin issues in great abundance, appearing of a milky whiteness at first, but gradually becoming of a dark reddish color, soft and elastic to the touch.

To what use is this substance put?

The Indians make of it boots, shoes, bottles, flambeaux, and a species of cloth. Amongst us it is combined with sulphur, forming the vulcanized rubber of commerce, which is used for many purposes. A greater proportion of sulphur, produces vulcanite, a hard black substance, resembling jet.

Flambeaux, torches burnt to give light.

What is Sponge?

A marine substance, found adhering to rocks and shells under the sea-water, or on the sides of rocks near the shore. Sponge was formerly imagined by some naturalists to be a vegetable production; by others, a mineral, or a collection of sea-mud, but it has since been discovered to be the fabric and habitation of a species of worm, or polypus.

What do you mean by Polypus?

A species of animals called Zoophytes, by which are meant beings having such an admixture of the characteristics of both plants and animals, as to render it difficult to decide to which division they properly belong. They are animal in substance, possessed indeed of a stomach, but without the other animal characteristics of blood-vessels, bones, or organs of sense; these creatures live chiefly in water, and are mostly incapable of motion: they increase by buds or excrescences from the parent zoophyte, and if cut off will grow again and multiply; each part becoming a perfect animal. Myriads of the different species of zoophytes reside in small cells of coral, sponge, &c., or in forms [109]like plants, and multiply in such numbers as to create rocks and whole islands in many seas, by their untiring industry. Polypus signifies having many feet, or roots; it is derived from the Greek.

Myriads, countless numbers.

Whence are the best and greatest number of Sponges brought?

From the Mediterranean, especially from Nicaria, an island near the coast of Asia: the collection of sponges forms, in some of these islands, the principal support of their inhabitants. They are procured by diving under water, an exercise in which both men, women, and children are skilled from their earliest years. The fine, small sponges are esteemed the best, and usually come from Constantinople; the larger and coarser sorts are brought from Tunis and Algiers, on the coast of Africa. Sponge is very useful in the arts, as well as for domestic purposes.

What is Coral?

A substance which, like sponge, was considered as a vegetable production, until about the year 1720, when a French gentleman of Marseilles commenced (and continued for thirty years,) a series of observations, and ascertained that the coral was a living animal of the Polypus tribe. The general name of zoophytes, or plant animals, has since been applied to them. These animals are furnished with minute glands, secreting a milky juice; this juice, when exuded from the animal, becomes fixed and hard.

Series, a course or continued succession.

Glands, vessels.

Exuded, from exude, to flow out.

Is this substance considered by naturalists as the habitation of the Insect?

Not merely as the habitation, but as a part of the animal itself, in the same manner that the shell of a snail or an oyster is of those animals, and without which they cannot long exist. [110]By means of this juice or secretion, the coral insects, at a vast but unknown depth below the surface of the sea, attach themselves to the points and ridges of rocks, which form the bottom of the ocean; upon which foundation the little architects labor, building up, by the aid of the above-mentioned secretion, pile upon pile of their rocky habitations, until at length the work rises above the sea, and is continued to such a height as to leave it almost dry, when the insects leave building on that part, and begin afresh in another direction under the water. Huge masses of rocky substances are thus raised by this wonderful little insect, capable of resisting the tremendous power of the ocean when agitated to the highest pitch by winds or tempests.

Architect, one who builds.

How do these Coral Rocks become Islands?

After the formation of this solid, rocky base, sea-shells, fragments of coral, and sea-sand, thrown up by each returning tide, are broken and mixed together by the action of the waves; these, in time, become a sort of stone, and thus raise the surface higher and higher; meanwhile, the ever-active surf continues to throw up the shells of marine animals and other substances, which fill up the crevices between the stones; the undisturbed sand on its surface offers to the seeds of trees and plants cast upon it by the waves, a soil upon which they rapidly grow and overshadow the dazzling whiteness of the new-formed land. Trunks of trees, washed into the sea by the rivers from other countries and islands, here find a resting-place, and with these come some small animals, chiefly of the lizard and insect tribe. Even before the trees form a wood, the sea-birds nestle among their branches, and the stray land-bird soon takes refuge in the

bushes. At last, man arrives and builds his hut upon the fruitful soil formed by the corruption of the vegetation, and calls himself lord and master of this new creation.

Surf, the white spray or froth of the sea waves.

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Where is the Coral Insect found?

In nearly all great seas; but particularly in the Mediterranean, where it produces Corallines of the most beautiful forms and colors: it is in the Pacific Ocean, however, where these tiny workmen are effecting those mighty changes, which exceed the most wonderful works of man.

What is that part of the Pacific called, where the Coral Rocks are most abundant?

The Coral Sea, from the number of coral reefs and sunken islands, with which it abounds; it includes a region of many miles in extent, the whole of which is studded with numberless reefs, rocks, islands, and columns of coral, continually joining and advancing towards each other. All navigators who have visited these seas, state that no charts or maps are of any service after a few years, owing to the number of fresh rocks and reefs which are continually rising to the surface. The wonderful instinct of these animals leads them to continue working without ceasing, until their labors are finished, or their lives extinct.

Reef, a chain or line of rocks lying near the surface of the water.

Extinct, at an end, dead.

What are the names of the principal islands of Coral formation?

The New Hebrides, the Friendly Isles, the Navigator's Isles, the Society Islands, the Marquesas, the Gambier group, and others. These groups are separated from each other by channels or seas, wider than those which divide the individual islands which form the respective groups; but all these waters abound with shoals and minor islets, which point out the existence of a common base, and show that the work by which they will afterwards be united above the level of the sea is continually going forward.

Shoals, shallows; places where the water is of little depth.

Minor, less, smaller than others.

Existence, being.

What is a singular characteristic of the Coral Islands?

On all of them a plentiful supply of sweet and fresh water [112]may be obtained by digging three or four feet into the coral; and even within one yard of high-water mark

such a supply is to be found. They are mostly covered with a deep rich soil, and well wooded with trees and evergreens of different kinds. These islands vary in extent, as well as in the degree of finish to which they have arrived; some of the largest being about 30 miles in diameter, and the smallest something less than a mile;—all of various shapes, and all formed of living coral.

Diameter, a straight line through the middle of a circle.

Is Coral put to any use by man?

White Coral, which is nowhere so abundant as about the shores of Ceylon, and others of the neighboring Indian coasts, is employed as lime by the inhabitants of that part of the world, for building houses, &c., by burning it after the manner of our lime. This coral lies in vast banks, which are uncovered at low water. Coral, particularly the beautiful red sort, is likewise made into various ornaments, as necklaces, &c.

Of what is our Lime composed?

Of a useful earth, which absorbs moisture and carbonic acid, and exists as limestone, or in marble and chalk, which, when burnt, become lime: in its native state it is called carbonate of lime, and is burnt to disengage the carbonic acid; when made into a paste, with one part water and three parts lime,[13] and mixed with some other mineral or metallic substances, it forms plastic cements and mortars; and afterwards, imbibing carbonic acid from the atmosphere, it becomes again carbonate of lime, as hard as at first; and hence its use in building.

[13] See Chapter XVI., article Lime.

Plastic, yielding, capable of being spread out or moulded.

What do you mean by Carbon?

A simple substance, whose most common form is purified charcoal: it is, in fact, the base of charcoal, divested of all impurities; combined with oxygen, it forms *carbonic acid* gas, [113]formerly called fixed air. It is diffused through all animal and vegetable bodies; and may be obtained by exposing them to a red heat. In its pure, crystallized state, it constitutes the diamond, and as graphite, is used in making the so-called lead-pencils.[14]

[14] See Chapter XIV., article Diamond.

What is Oxygen?

Air, mentioned in the first chapter of this work as the gaseous substance which composes the atmosphere, is formed by a mixture of two distinct elements, one called Nitrogen, or Azote, the other Oxygen. Oxygen is, therefore, an element or simple

substance diffused generally through nature, and its different combinations are essential to animal life and combustion. It is, in fact, the most active agent in nature, and the principle of acidity and combustion. So wholesome and necessary is oxygen to life, that it is often called vital air.

Agent, an actor; a person or thing possessing the faculty of action.

Essential, necessary.

What are the properties of Nitrogen or Azote?

Nitrogen is a substance also generally diffused through nature, and particularly in animal bodies, and causes great changes in those absorbing or exposed to it. This gas, combined with oxygen and hydrogen, produces neither light, heat, nor combustion, but serves to dilute the others: of itself, it is hurtful to animal life. Nitrogen makes the principal part of the salt we call *nitre*.

What is meant by Combustion?

The decomposition of bodies by the action of fire; the union of combustible bodies with the oxygen of the atmosphere. The greater access the air has to a burning body, the more rapid and complete is the process.

Combustible, capable of taking fire.

Access, the means or liberty of approach to anything.

Are all bodies equally combustible?

No; some are more so than others, and burn with a bright flame; as wood, dry vegetables, resins, oils, fats, &c.; others with difficulty, and without any sensible flame, as soot, coal, the ashes of plants, &c. There are bodies, also, which are incombustible—that is, incapable of taking fire, as some alkalies, earths, &c.

What is Caloric?

Caloric is that invisible agent which produces the sensation of heat. It exists in all bodies; it is a force we are ever in want of, and thus it is hid in everything around us, and penetrates all matter, however different may be its nature or properties.

What is meant by Gas?

All highly elastic fluids are called gases. Some are salutary, but many extremely noxious, especially such as those arising from the putrefaction of animal bodies; the burning of charcoal; corrupted air at the bottom of mines, cellars, &c. The inflammable gas, which lights our streets, churches, shops, &c., is procured chiefly from coal, burnt

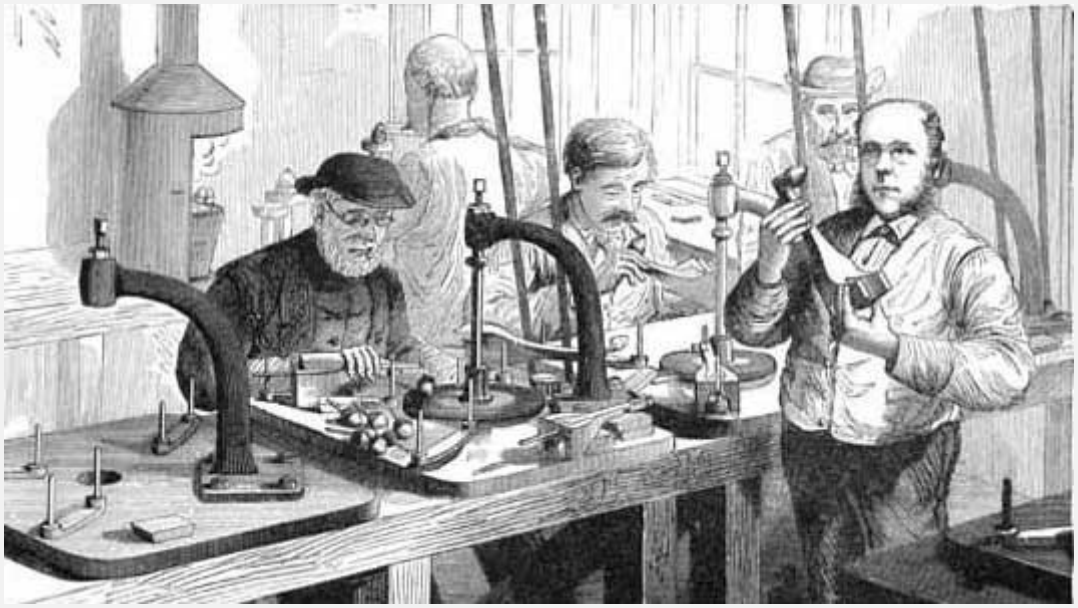
in furnaces for the purpose the gas being passed through metal pipes, conveyed underground to the places where the light is required: escaping at the orifice prepared for it, it is lighted when wanted, and burns with, a brilliant flame. This gas consists of hydrogen and carbon; and the oxygen of the air, combined with the hydrogen, causes light as long as hydrogen and oxygen exist and combine.

Salutary, wholesome, healthful.

Noxious, hurtful, unwholesome.

Putrefaction, decay.

Orifice, opening, hole.



DIAMOND CUTTING AND POLISHING.

What is Hydrogen?

One of the most abundant principles in nature; one part of it, and eight of oxygen, form water. It is only met with in a [115]gaseous form; it is also very inflammable, and is the gas called the fire-damp, so often fatal to miners; it is the chief constituent of oils, fats, spirits, &c.; and is produced by the decomposition of water.

Constituent, that which forms an essential part of anything.

What is Chalk?

A white fossil substance, by some reckoned a stone, but of a friable kind, which cannot, therefore, be polished as marble; by others, more properly ranked among the earths. It is of two sorts, one a hard dry chalk, used for making lime; the other a soft, unctuous kind, used in manuring land, &c. Chalk always contains quantities of flint-stone, and

the fossil remains of shells, coral, animal bones, marine plants, &c.; from which circumstance there can be no doubt that *chalk is the deposited mud of a former ocean*. The chemical name of chalk is carbonate of lime. It effervesces strongly with an acid.

Effervesce, to froth or foam up.

Deposited, placed on anything.

Where is Chalk found?

In large beds or strata in the earth. Chalk, on account of its abundance in England, forms an important feature in the scenery and geology of that country; it causes the whiteness of its sea-cliffs. Scotland and Wales are entirely without chalk. The white chalk is found, with interruptions, over a space above eleven hundred miles long, extending from the north of Ireland, through England, France, Belgium, Germany, Poland, and Southern Russia, to the Crimea, with a breadth of more than eight hundred miles. The Island of Crete, now called Candia, situated in the Mediterranean, was formerly noted for its chalk. This substance is very useful in many of the arts and manufactures.

Where is the Crimea?

The peninsula of the Crimea is a part of Russia, lying on the Black Sea, by which it is bounded on the west and south.

Are there any other kinds of this earth besides the common white chalk?

Yes; there are various kinds of chalk, distinguished by their different colors, as white, black, red, &c., found in various parts of the world, of great use to the painter, both in oil and water colors, and for drawing on paper, &c.

What is Marble?

A kind of stone remarkable for its hardness and firm grain, and for being susceptible of the finest polish. It is dug in great masses from pits or quarries; and is much used in ornamental buildings, and for statues, altars, tombs, chimney-pieces, &c. The word is derived from the French *marbre,* marble. Marble is supposed to be formed, deep within the bowels of the earth, from a loose and porous carbonate of lime, subjected to enormous heat and pressure.

Susceptible, easily admitting anything additional.

Porous, full of holes, or interstices.

Are there different sorts of this Stone?

Marbles are of many different kinds, usually named either from their color or country; some of one simple color, as white, or black; others streaked or variegated with different colors. They are classified as ancient and modern: the ancient are those found in quarries now lost or inaccessible to us, and of which there are only some wrought pieces remaining;—the modern, those from quarries still open, and out of which blocks of marble continue to be taken.

In what countries is Marble found?

The United States, Great Britain, France, Spain, Italy, Africa, Egypt, and many other countries, produce marbles of different colors and qualities; some more beautiful, valuable, and more highly esteemed than others, as those of Egypt, Italy, &c. Those, also, of different places in the same country frequently differ from each other in quality and appearance Of the European marbles, that of Italy is the most valuable.

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What kind appears to have been held in the greatest esteem by the ancients?

A beautiful white marble, called the Parian; of which the Grecian statues were mostly made. By some, it is supposed to have taken its name from the Isle of Paros, in the Mediterranean; but by others from Parius, a famous statuary, who made it celebrated by cutting in it a statue of Venus. Parian marble is often mentioned by ancient authors.

Statues, figures of men, animals, &c., cut in stone or marble.

Statuary, one who makes statues.

Who was Venus?

The goddess of love and beauty, who was an object of adoration in the idolatrous ages, when men ignorantly knelt down and worshipped stocks and stones, which their own hands had fashioned after the likeness of things on the earth, or imaginary creations of their fancy;—or, again, the sun, moon, and stars, instead of the one and only true God. In those times, every nation had its peculiar deities, to whom were paid divine rites and honors, and to whose names costly temples were dedicated: these deities were divided into two classes, superior and inferior. Venus was one of the Grecian goddesses, supposed by them to have sprung from the froth of the sea. Kings and celebrated warriors, and sages too, after death, frequently received divine honors; as Confucius, the founder of the Chinese empire, who, after death, was worshipped by that people as a god. Romulus, the first king of Rome, likewise, was thus adored by the Romans; and many similar instances of the same species of idolatry amongst other nations might be recorded.

Deities, fabulous gods or goddesses.

Idolatrous, given to the worship of idols.

Superior, higher in rank.

Inferior, of a lower rank.

Sage, a wise man.

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CHAPTER XIV.

GOLD, SILVER, LEAD, TIN, PLATINA, SULPHUR, GEMS OR PRECIOUS STONES, AS DIAMONDS, RUBIES, EMERALDS, TURQUOIS, PEARLS, MOTHER-OR-PEARLS, AND IVORY.

What is Gold?

The purest and most precious of metals: it is sometimes found in solid masses, as in California, Peru, Hungary, &c.; in a shape resembling the branches of plants; in thin plates covering other bodies, as in Siberia; sometimes in a crystal form. It, however, generally occurs in a metallic state, and most commonly in the form of grains.

What is it called when found in a perfect metallic form?

Native gold: it is, however, seldom met with perfectly pure, being frequently alloyed with silver, copper, iron, or platina; sometimes concealed in other minerals; from which, if sufficiently abundant, it is extracted by art.

Where and in what manner is Gold generally found?

All parts of the earth afford gold; though with great difference in point of purity and abundance. It is chiefly obtained from mines. Many rivers contain gold in their sands, especially those of California and Guinea. Gold mines are of rare occurrence in Europe, but the metal is found in some of its rivers; among its mines, those of Upper Hungary are the most considerable. China and Japan are rich in this metal; many parts of Asia also possess it. Australia produces quantities of the metal. It is also found in the eastern parts and interior of Africa, where gold dust is collected in great quantities from earth deposited by the rivers. But it is in America that gold is found in the greatest abundance, particularly in the State of California, and in some parts of South America, as Brazil, Peru, Chili, &c.

Guinea, a country of Western Africa.

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What are the uses of Gold?

It is used for money, jewelry, plate, &c. It is also employed in various ways in the arts.

What is the character of Gold?

Gold is so ductile and malleable, that an ounce of it may be drawn into a thread of 73 leagues in length; or beaten into 160 leaves of 9 inches square, and thin enough to be carried away by the slightest wind. It readily assumes any form that human art can bestow upon it: its color is unalterable, and the beautiful polish of which it is susceptible, renders it the best of all metals for ornamental purposes. It is indestructible by air, water, or fire. Gold is the heaviest of all metals, except platina; it is neither very elastic, nor very hard.

League, a measure of length containing three miles.

Indestructible, incapable of being destroyed.

Is not the use of Gold quite ancient?

Yes; it appears to have been very early known to the inhabitants of the world. In the 13th Chapter of Genesis, Abram is spoken of as very rich in silver and gold; and in the 2d Chapter of the same book, the "land of Hevilath" (now in the eastern part of Arabia Felix,) is pointed out as having gold. Arabia was famed for the fineness and quality of its gold. In the time of Solomon, the gold of Ophir seems to have been much esteemed, as it is recorded that the gold used in the building of the Temple was brought from that place by the merchant-vessels of Hiram, King of Tyre. Ophir is supposed to have been situated somewhere in the East Indies.

What is Silver?

A beautiful white shining metal, next to gold in value, and, like that precious substance, of great antiquity. It is found in Sweden, Norway, and the polar latitudes: when it occurs in hot climates, it is generally amidst mountains, covered with perpetual snow.

Latitude, breadth, width; in Geography, the distance of a place in degrees, north or south, from the Equator.

Where are the richest Silver Mines found?

In South America, especially among the Andes; the mines of Mexico, and those of Nevada, also, are rich in this metal. The richest and most important silver mines in Europe are those of Königsberg, in Norway, and of Andalusia, in Spain. With the exception of gold, silver is the most ductile of all metals: a single grain may be extended into a plate 126 inches long, and half an inch broad. It is capable of still further

extension, but its tenacity is inferior even to that of iron or copper. A silver wire one-tenth of an inch thick will scarcely bear a weight of 290 pounds, whilst a gold wire of the same thickness will support nearly double that weight. Like some other metals, it is unalterable by air or moisture, but by an intense heat may be volatilized, being sometimes found in the soot of chimneys where large quantities are melted.

Volatilized, made to fly off by evaporation.

In what state is Silver usually found?

It is rarely found in a state of purity, being generally mixed with other metals, as gold, lead, &c. Masses of native silver are of no determinate form; being found sometimes in small branches, sometimes in threads, or very frequently in leaves, as in the Siberian mines. Native, or pure silver is chiefly found in the mines of Potosi. Silver was used as money in commerce 1100 years before the foundation of Rome.

Commerce, trade of one nation with another, or different persons, &c. with each other.

What is Tin?

A white metal, softer than any other excepting lead, more elastic, and more sonorous. Though tin is the lightest of all metals, its ore is, when rich, the heaviest of all metallic ores. It has both smell and taste; is less ductile than some harder metals, though it may be beaten into very thin leaves; and it fuses so quickly, that it requires a heat much less than is sufficient to make it red-hot.

Was not the use of Tin very early known?

Tin was found in Britain from the earliest ages; the Phenicians traded to Cornwall for this metal 600 years before Christ.

Where are the principal Tin Mines?

In Saxony, Cornwall, and Bohemia. Tin is also found in Spain, Sumatra, Siam, Mexico, and Chili. A few specimens have been found at Goshen, in Massachusetts.

Specimens, samples.

In what state is Tin generally found?

Tin is sometimes found native or pure, but most frequently alloyed with other metals: the working of tin mines is attended with much difficulty, on account of their great depth, and the hard rocks which obstruct the progress of the miners, who are often obliged to cut through them. This metal is very useful in the making of domestic

utensils, for coating the inside of copper and iron vessels, and for various other purposes.

Obstruct, to stand in the way.

What is Lead?

A coarse, heavy metal, of a bluish grey color: it is so soft and flexible, that it is easily cut with a knife, and rolled out into sheets, &c.; it is very fusible and inelastic, but less ductile and sonorous, than any other metal. Next to gold, platina, and mercury, it is the heaviest of the metals, being eleven times heavier than an equal bulk of water. This metal loses its malleability in proportion as it is heated: as soon as it melts it calcines, and greyish-colored ashes are formed on its surface; when returning from a fluid to a solid state, it is easily divided into small grains or powder, or formed into shot, &c. Lead was in common use among the ancients.

Flexible, yielding, easily bent.

Sonorous, giving sound when struck.

Where is Lead found?

In various countries; but it abounds principally in Great Britain and Spain; the lead mines of Illinois, Wisconsin, and Iowa, are among the richest in the world. Lead is a metal of [122]great utility; it easily melts and mixes with gold, silver, and copper; hence it is employed in refining gold and silver, as it separates all the dirt and impurities from them; it is much used in building, particularly for covering gutters, pipes, &c.; lead is also used in varnishes and oil-painting, and makes the basis of the glazing of all the earthen and pottery wares.

Refining, cleansing, purifying.

Varnishes, preparations for beautifying and preserving various articles.

What is peculiar to the ore of Lead?

The ore of this metal is so poisonous, that the steam arising from the furnaces in which it is smelted infects the grass of all the neighboring places, and kills the animals which feed on it: culinary vessels lined with a mixture of tin and lead, are apt to convey pernicious qualities to the food prepared in them. There are various preparations of lead, serving for different purposes.

Infects, corrupts.

Culinary, adapted to the purposes of cooking.

Pernicious, hurtful, dangerous.

Ore, the mineral soil, earth, or stone dug out of the mines, which contains the metal.

What is Black Lead?

It is a kind of mineral, of a deep shining black or bluish color, soft and unctuous to the touch; it is insoluble in acids, and infusible by fire. Black lead has been found in many parts of the world, in a state of greater or less purity, but it is the English black lead which is the most esteemed.

Insoluble, incapable of dissolving.

Infusible, not capable of being melted.

Is Black Lead a proper term for this mineral?

No; because, in reality, there is not a particle of lead in it. On the spot where it is procured, it is called by two or three different names, but the most usual is Plumbago.

Where is the best Black Lead found?

The best and greatest quantity is found in England, in a mine near Keswick, in Cumberland. It is much used for pencils or crayons, for writing, drawing, &c.; for this purpose it is sawn [123]into slips, and fitted into a groove in a strip of soft wood, as cedar, &c., over which another is placed and fastened with glue.

What is Platina?

A metallic substance, more recently discovered than the metals already described; and analogous to the perfect metals, especially gold,—many of whose properties it possesses.

Analogous, bearing a resemblance.

Whence is its name derived?

It is the diminutive of *plata*, silver, to which it appears very similar; platina being a silver-colored metal, in small grains.

Diminutive, a word lessening the meaning of the original.

Whence is it obtained?

Mostly from Russia, and, also from South America. Its color does not tarnish by exposure to the air, and appears to be equally permanent with that of pure gold; the metal is indestructible by fire. Platina is capable of being alloyed with all metals; is fused with difficulty, but by great labor may be rendered malleable: it is also the heaviest metal, being 21 times heavier than water.

Permanent, lasting.

Are there any other Metals besides those already mentioned?

In addition to the metals known and used by the ancients, the chemical science of later ages has, by decomposing other earths, added more than thirty to the number of metals, some of them more curious than useful; several of these are lighter than water. All the metals possess different and distinct properties from each other. They are divided into two classes, the malleable and the brittle metals. These last may be again divided into two others,—namely, those which are easily, and those which are with difficulty fused.

What do you mean by Metallurgy?

The art of obtaining metals from their ores, comprising the [124]processes of assaying, refining, smelting, &c. By assaying is meant, the particular manner of examining an ore or mixed metal, according to its nature, so as to discover not only what metals and what proportions of metal may be obtained from it, but also what other mineral substances or earths may be contained in it.

What do the terms Refining and Smelting signify?

Refining is the art of rendering the metal free from all impurities. Smelting means the melting of a metal from its ore in a smelting furnace, in order to separate the metallic parts from the sulphur, arsenic, and the earthy and stony substances with which they may be combined.

What is Sulphur?

An inflammable, fossil substance, of a dry, solid, friable nature, melting with a small proportion of heat;—when fired in the open air, burning almost entirely away with a blue flame and noxious vapor. It is abundantly diffused in many places, especially where metallic minerals are found; but more particularly in those districts where subterranean fires and volcanoes exist. It is also found combined with many different substances.

Describe the nature of Sulphur, and the places where it is mostly found.

Sulphur almost pure, called native or virgin sulphur, is found in volcanoes and grottoes, in the form of transparent crystals; but the greatest quantity which exists naturally is combined with metals in ores. Sulphur is both fusible and volatile,—which qualities enable us to procure it from those minerals by the process of sublimation: it unites easily, in different degrees, with all metallic matters, excepting gold, platina, and zinc.

Sublimation, the act of bringing a solid substance into the state of vapor by heat, and condensing it again by cold.

Are not its uses very extensive?

Yes, both in the arts and in chemistry: it is well known to [125]be a principal ingredient in the preparation of gunpowder and fire-works; it is also used for whitening wool, straw, silk, &c.; many other matters exposed to the vapors of sulphur when burning, quickly lose their color, which no other substance had been able to destroy. Sulphur is also frequently found in mineral waters.

Whence are the greatest quantities of Sulphur brought?

The largest quantities are brought from Saxony, in irregular masses, which are afterwards melted and cast into small rolls. There are about four species of sulphur; namely, the yellow native sulphur, which in its purest state is clear, and of a pale straw color, found in the gold mines of Peru; in Hungary, and some other places: the green native sulphur, which is harder than the other, is found in small crust-like masses; this sort is chiefly confined to Mount Vesuvius: and the grey native sulphur, common in Iceland and many other places. Native sulphur is also found at the coal mines, near Richmond, Virginia; in Connecticut, Pennsylvania, and other parts of the United States.

Which is the most rare and beautiful of all the kinds?

The red native sulphur; it is mostly of a fine glowing red, very bright and transparent; it is found, like the first-mentioned sort, in the gold mines of Peru. Common sulphur, such as is used in trade and the arts, is of a pale yellow color; and possesses a peculiar and disagreeable smell, particularly when heated or rubbed. This is mostly extracted from the metallic sulphurets, and is commonly called brimstone. It is the sort employed in making matches.

Is there not another substance also employed in the manufacture of matches?

Yes: Phosphorus, a peculiar substance, chiefly of animal origin. It is mostly procured by the decomposition of the phosphoric acid which is found in bones. It was accidentally [126]discovered at Hamburgh, in 1669, by an alchemist named Brandt.

Alchemist, one skilled in Alchemy.[15]

[15] See Chapter XVIII., article Chemistry.

What is the nature of Phosphorus?

It is a solid, inflammable substance, which burns when in contact with atmospheric air. It is used in various chemical experiments, and for making matches; for various kinds of fire-works, &c. It will combine with all metals except gold and zinc; and also with some earths. Some animals, as the glow-worm, possess very peculiar phosphorescent qualities.

Phosphorescent, having a phosphoric property, emitting peculiar light like phosphorus.

What is Arsenic?

A heavy metallic substance, very volatile, and highly inflammable; so caustic or corrosive to animals, as to become a violent poison in all its states. In its metallic state it is used in several of the arts: it is employed in the manufacture of factitious metals: it is of use to the dyer in forming some of his colors; and for that purpose is generally combined with potassa. It is used in the making of small shot, and also in the manufacture of glass, to which it gives transparency; in whitening copper; in calico printing; in the preparation of colors for the painter; and in the working of platina, and some other metals, to render them more easily fusible.

Caustic, dry, burning.

Corrosive, apt to corrode, to eat away, to penetrate.

How is the white powdered arsenic prepared?

By submitting the ore to a strong heat in a peculiar kind of furnace; this produces a dark grey powder, which is again heated in close iron vessels; this separates it from its impurities, and the arsenic is obtained in thick, solid masses; these, by exposure to the air, fall into a fine, white powder.

From what is the word Arsenic derived?

From a Greek word, signifying *masculine*—powerful (as a poison). Arsenic is dug out of mines in Saxony, near Goslar; in Bohemia; in England, in the Mendip Hills, in great quantities. It has so strong a corrosive quality as sometimes to burn the hands and feet of the miners; it is a deadly poison for all known animals. This poisonous mineral is not found native in its perfect form, being generally united with metallic ores.

What do you mean by Gems?

The word gem is used as a common name for all precious stones or jewels; they consist of the siliceous earths; and are much valued for their lustre, transparency, color, hardness, and rarity. There are many different kinds of precious stones, each distinguished by its peculiar character.

How are they divided?

Into the pellucid gems, which are of great lustre, and extremely hard, as the diamond; the semi-pellucid, those which are not so transparent, but yet of great beauty; those of one color, as the emerald or turquois; and those variegated or veined with different colors. Gems are sometimes found of regular shapes, with a natural polish, near the

beds of rivers after great rains; these are of the pebble kind. Sometimes they are found of irregular shapes, with a rough coat, in mines and the clefts of rocks. Pearls, though not stones, are also ranked among the number of gems.

Pellucid, clear as a drop of water.

Semi-pellucid, half pellucid.

Describe the Diamond.

The diamond is a precious stone, the first in rank of all the gems, and valued for its beautiful lustre; it is the hardest of all stones, as well as the most valuable. The most esteemed are colorless. A diamond in its natural state as it comes out of the mine, and before it is cut, is called rough, because it has no brilliancy, but is covered with an earthy crust. The diamond [128]is the Adamant of the ancients; hence the expression "hard as adamant," from its being the hardest substance in nature. The cutting of diamonds is a work of labor, and requires great skill; the polishing is performed by a mill of simple construction.

Where are they mostly found?

In yellow ochreous earths; in mines; and likewise in torrents, which have torn them from their beds. In former times, all the diamonds that were known were brought from the famous mines of Golconda, in Hindostan; the islands of Molucca and Borneo have also produced many valuable stones. The diamond mines of Golconda are now so exhausted, that they are not thought worth the expense of working; these gems are now brought chiefly from Brazil, in South America.

What is meant by Ochreous?

Consisting of ochre, a kind of earth with a rough and dusty surface, composed of fine, soft, clayey particles, which readily separate in water. There are various colored ochres, as red, yellow, blue, green, &c.; they are very useful in many of the arts.

What term is used to denote the quality of the Diamond?

In speaking of the value of diamonds, we distinguish them as "diamonds of the first water," meaning those which possess the greatest perfection and purity, which ought to be that of the clearest drop of water: when they fall short of this perfection, they are said to be "of the second or third water," and so on till the stone may be properly called a colored one.

What is the Ruby?

A beautiful gem of a red color; in its perfect state it is of great value. The ruby is often found perfectly pure and free from all spots or blemishes; but its value is much more

frequently lessened by them, especially in the larger stones. It is very hard, being second only to the diamond in this respect; and is often naturally so bright and pure on the surface as to [129]need no polishing; it is often worn in rings, &c., in its rough or native state. The color of rubies varies from the deepest to the palest red, all having more or less of a purplish tinge, which is more plainly perceived in the deeper colored specimens than in the paler ones.

Where are Rubies found?

They are mostly found in gold mines. We have the true rubies only from the East. The Isle of Ceylon has long been celebrated for these gems; they are found in a river which descends from the mountains; they are brighter and more beautiful than those obtained in other parts, but are very rare. Some crystals are frequently found tinged with the true color of the ruby, but these want its lustre and hardness.

Describe the Emerald.

It is a precious stone of a beautiful transparent green color, and, when in a state of perfection, nearly equal to the ruby in hardness. The finest and best are found in America, especially among the mountains of Peru; they are also obtained from a few places in the East. These gems are often counterfeited, as are most of the precious stones, there being even false diamonds; the genuine may be known by their extreme hardness and brilliancy.

Counterfeited, imitated with a view to defraud.

Genuine, true, real.

What is the Turquois?

A beautiful blue stone; it is one of the softest of the gems, and some varieties are often used for seals, as they admit of being engraved upon. The turquois is easily imitated, and that often so perfectly as to render it very difficult to distinguish the counterfeit from the true gem.

In what countries are they found?

The Oriental Turquois comes from Persia, the Indies, and some parts of Turkey; the turquois is also found in various parts of Europe, as Germany, Spain, and France.

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What is Engraving?

The art of cutting metals or precious stones, and representing thereon figures, letters, and devices; the term is, however, more particularly applied to the art of producing figures or designs on metal, &c., for the purpose of being subsequently printed on paper.

The ancients are well known to have excelled in engraving on precious stones; many specimens have been preserved, which surpass anything of the kind produced by the moderns. This art is frequently alluded to in the Bible. Engraving on wood, according to some authors, was introduced into Europe from China by Venetian merchants; it is certain the art was practised in eastern and northern Italy as early as the thirteenth century. The invention of copper-plate engraving has been ascribed to a goldsmith of Florence, about the year 1460.

Device, that which is formed by design.

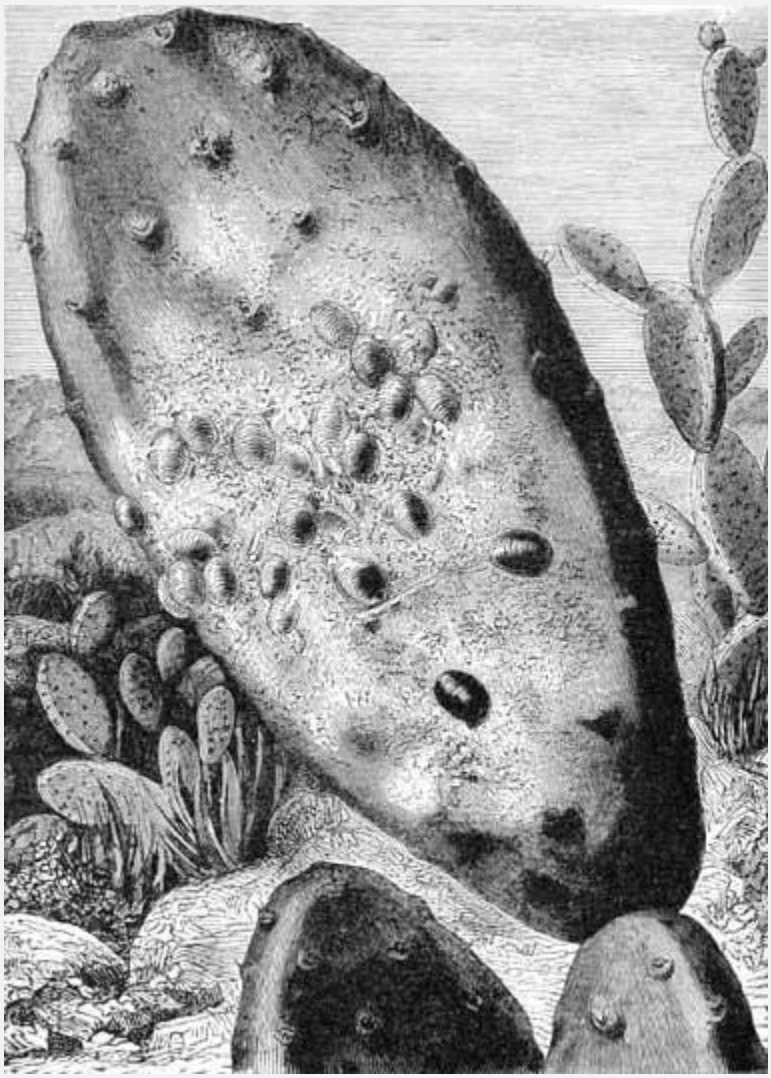
Design, a representation of a thing by an outline; a sketch.

Describe Wood Engraving.

The subject is drawn on a block of box or pear-tree wood with a black-lead pencil, or with a pen and Indian ink; the wood is then cut away, so as to leave the lines which have been drawn, as raised parts. The ink is next applied, and by pressing damp paper upon the block, the impressions are obtained. Albert Durer, a celebrated painter of Germany, brought the art of engraving on wood and metal, and taking off impressions on paper, &c., to great perfection.

How is engraving on copper, steel, &c., performed?

This sort of engraving is performed with a sharp-pointed instrument called a *graver*, by means of which figures, landscapes, &c., are traced upon a flat surface of the metal: the lines are then filled with ink or a similar composition, and the paper pressed on the plate. When taken off, an exact copy of the plate is impressed upon its surface.



COCHINEAL INSECTS AND PLANTS.

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What is Lithography?

A species of engraving on stone, from which impressions can be taken much more expeditiously and economically than from metal. The process depends upon the following principles:—First, the facility with which calcareous stones imbibe water; second, the power of oily substances to repel water. When drawings are executed upon the stone with crayons composed of oily materials, and the surface of the stone is washed over with water, the moisture is imbibed by the stone, but repelled from the engraving; and when the ink, which also contains oily substances, is applied, it adheres only to the drawing, and not to the other portions of the stone. The block is then passed through a press, and the impressions are taken off; as many as 70,000 perfect copies have been obtained from a single stone.

Expeditiously, with celerity or dispatch.

Economically, with economy; with frugality.

You describe Pearls as being ranked among the number of Gems, although they are not Stones; what kind of substance are they?

Pearls are excrescences found in the shells of a large species of oyster, which are supposed to be produced by a disease of the fish. The best pearls are generally taken from the most fleshy part of the oyster, near the hinge of the shell, but inferior kinds are found in all parts of the fish, and adhering to the shells. Pearls, from many allusions made to them in the Old Testament, were not only known to the ancients, but were regarded by them as costly and precious gems.

How do they get the Oysters which contain them?

By diving under water and picking the oysters from the large beds at the bottom of the sea; or the rocks to which they adhere. The divers cast all the oysters they take into their boats, and carry them ashore, where they deposit them in heaps; they are then left till they become putrid, this being necessary in order to remove the pearls easily from the rough matter by which they are surrounded.

What sea produces the best and greatest number of Pearls?

The finest and greatest quantities are obtained off the coast of Ceylon; the pearl oyster is also found in the seas of the East Indies; in those of America, and in some parts of the European seas; but these last are much inferior. The Oriental pearls are the finest on account of their size, color, and beauty, being of a silvery white; while the Occidental pearls are smaller, and frequently tinged with a yellow or blackish hue.

Tinged, slightly colored.

Does not the Pearl Oyster produce a substance called Mother-of-Pearl?

No; the beautiful substance so much used for inlaying boxes, and for ornamental knife-handles, &c., is produced from the shell, not of the pearl oyster, but of another sea-fish of the oyster kind.

What is Inlaying?

The art of ornamenting a plain surface of wood, or other material, with thin slices or leaves of a finer wood, of a different kind; as mahogany inlaid with ebony, &c., or with ivory, and other substances. There are two kinds of inlaying; one, of the more ordinary sort, which consists only of compartments of different kinds of wood, inlaid with one another; the other, requiring greater skill, represents flowers, birds, and other figures.

The thin plates of wood or other substance, being sawed into slips, and cut into the required forms, are carefully joined, and afterwards strongly glued down on the block of wood, &c., intended to be thus ornamented.

Compartment, a division, a separate part.

What is Ebony?

A hard, black-colored wood, growing in the countries of the Levant, &c.; there are, however, several black woods of different kinds which are also called ebony.

What is Ivory?

The tooth or tusk of the Elephant, which grows on each side [133]of his trunk; it is somewhat like a horn in shape. Ivory is much esteemed for its beautiful white color, polish, and fine grain when wrought. It has been used from the remotest ages of antiquity; in the Scriptures we read of Solomon's ivory throne, and also of "vessels of ivory," and "beds of ivory:" by which it appears to have been a chief article of luxury, as well as of trade.

Remotest, most distant.

Of what countries is the Elephant an inhabitant?

Of many parts of Asia and Africa. The elephant is the largest quadruped now in existence; it is extremely sagacious, docile and friendly: in the countries where they live they are trained to useful labor, and by their great strength are enabled to perform tasks which a man or horse could not accomplish: among the native princes they were, and even still are, used in war: with them the inhabitants are able to hunt and destroy the lion, tiger, and other beasts of prey. With their long trunk, or proboscis, they can perform almost everything which man can with his hands.

Quadruped, an animal with four feet.

CHAPTER XV.

STARCH, ARROW-ROOT, TAPIOCA, ISINGLASS, CAVIARE, THE VINE, WINE, GIN, RUM, BRANDY, VINEGAR, INDIGO, GAMBOGE, LOGWOOD, TAR, PITCH, CAMPHOR, MUSK, MYRRH, FRANKINCENSE, AND TURPENTINE.

What is Starch?

A white, powdery sediment procured from the bottom of vessels in which flour or meal has been steeped in water. Pure starch is of a fine white color, without taste or smell; it

will [134]not dissolve in cold water, but with warm forms a jelly, in which form it is generally used; it is made by crushing, soaking, and fermenting the grains of the cereals, and then washing in pure water; the water is then evaporated, leaving behind the starch.

Sediment, matter subsided to the bottom of liquors.

For what is Starch used?

To stiffen linen after washing; to make hair powder; and for other purposes in the arts.

From what vegetables is Starch obtained?

All farinaceous vegetable substances afford it, as the potato, horse-chestnut, &c. Starch being the nutritive part of the vegetable, forms an excellent food for invalids, and constitutes the principal part of arrow-root, tapioca, &c.; the different flavor of these substances being derived from the mixture of a small portion of foreign matter peculiar to the plants which yield them. Starch is procured from potatoes by crushing them to powder, and then proceeding as in the manufacture of wheat starch.

What is Arrow-root?

The starch obtained from the root of an American plant by pulverization. It is often adulterated with potato starch, and the latter is even sold instead of it, for the two kinds resemble each other so closely that they can hardly be distinguished.

Pulverization, the act of reducing to powder.

Adulterated, corrupted by foreign mixture.

What is Tapioca?

Tapioca is another kind of starch, obtained from the root of the manioc plant, which is cultivated in most hot climates, in Asia, Africa, and America. A flour is also prepared from it, which is used for making bread. It is particularly cultivated in the tropical parts of America, and in the West India islands, where it forms a very important article of food for the Negro population.

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Negro, a name given to the black inhabitants of Africa and their descendants.

Population, inhabitants of a place or country.

What is Isinglass?

One of the purest and finest of *animal* glues. It is the produce of several kinds of fish, but especially of the sturgeon, which inhabits the seas of Northern Europe and America.

From what part of the fish is it prepared?

From the air-bladder, and certain parts of the entrails; these are taken out while fresh, cut open, washed, and exposed to the air a short time to stiffen; the outside skin is then taken off, and the remaining part formed into rolls, fastened together with pegs, and hung up to dry. The isinglass is then separated into threads of different sizes, or formed into flakes. Immense quantities are annually prepared in this manner in Russia.

What are its uses?

Dissolving readily in water or milk, it yields a mild nutriment for the sick, and enters into the composition of many delicacies for the table, such as jellies, &c. It is mixed with gum to give lustre to silk and satin; it is also used in making court plaster, and for clarifying various liquors. Gelatine, now much used on account of its being less expensive, is a similar preparation, but of an inferior quality.

What else does the Sturgeon supply?

Its roe furnishes the delicacy called Caviare, which is in fact merely that part of the fish separated from the membranes and washed in vinegar and white wine, and dried in the air. It is then well salted, and packed up in barrels ready for sale. This is the method of preparing it in Russia, where large quantities of it are consumed. It is largely exported to Italy, where it is highly esteemed. It is unwholesome, and at present the demand for it, except in Russia and Italy, is very limited. The best is dry and of a brown color, and is eaten with lemon juice on bread.

To what other uses is the fruit of the Vine applied besides drying it for raisins, as described in the sixth chapter?

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The well-known plant, called the Vine, has been an object of culture from the earliest ages of the world, for the sake of the fermented liquor obtained from its fruit; soon after the flood, Noe, who appears to have been the first "husbandman," is mentioned as having "planted a vineyard," and drank of the juice of the grape; in all those countries where it flourishes, it is inseparably connected with their religious rites, and wine, like corn, formed one of the principal articles which they offered on their altars to the gods whom they worshipped.

Husbandman, one who cultivates the fruits of the earth.

Altar, the place where sacrifices were anciently offered to some deity.

What countries produce the best Wines?

The wines of France are generally admitted to be the finest; the principal ones are Champagne, Burgundy, and Claret. Of each of these, there are several varieties, celebrated for their peculiar flavor; they are generally named after the places where they

are made. Spain, Portugal, Italy, Germany, Hungary, Sicily, Greece, and California, also produce their various sorts of wine, each esteemed in its kind.

May Wine be extracted from other vegetable bodies?

The word is appropriated in a more particular manner to the fermented juice of the grape; but nearly all vegetable productions may be made to afford wine. That produced from Apples is called Cider; that from Pears, Perry. A kind of wine, called Mead, is prepared from honey and water.

Appropriated, applied to.

What is Honey?

A sweet vegetable juice, collected from the flowers of various plants by the bees.

What Honey was reckoned by the ancients the best in the world?

The honey of Hybla, on the east coast of Sicily, and of Hymettus, a mountain of Greece, near Athens.

What other fluid is drawn from Wine?

Spirits; by this term is understood, a volatile fluid called spirits of wine, or alcohol, obtained by distillation from wine, beer, and all fermented liquors. It is colorless, and of a strong penetrating taste and smell. It is of great use in chemistry; in dyeing to prepare the stuff for receiving colors; and in many of the arts.

What is the vessel called which is used in Distilling?

A Still. It is a vessel so formed as to collect the vapor, which is the spirit, or alcohol, separated from the liquid from which it is drawn. This liquid product is itself returned to the still; and the same process is several times repeated, till the alcohol or spirit is sufficiently strong and pure. There are three principal spirits used in this country, as gin, rum, and brandy.

Product, thing produced.

What is Gin?

A spirit procured from raw barley, oats, and malt, mixed together in certain proportions: there are several varieties of this spirit, all obtained from grain. The peculiar flavor of gin is given by infusing a few hops and some of the berries of the juniper fir.

What is Malt?

Malt is barley prepared by being steeped in water and fermented, and then dried in a kiln. It is used for making beer, &c.

Of what are Hops the produce?

Of a graceful climbing plant, the blossoms of which are used in making beer, to preserve it and improve its flavor.

What is Rum?

A spirit obtained from molasses, the fluid which drains from sugar while it is crystallizing.

What is Brandy?

A spirit distilled from any wine; but the best is procured from weak French wines, which are unfit for exportation. [138]Brandy, from whatever wine it has been obtained, is at first colorless; different methods are employed to give it the color by which it is distinguished.

Exportation, the act of sending articles from one country to another.

What is Vinegar?

An agreeable, acid, penetrating liquor, prepared from wine, beer, &c. To make vinegar, the wine or beer is made to undergo a second fermentation, called the *acid* or *acetous* fermentation; the first which the vegetable juice had to undergo, in order to convert it into wine or beer, being called the *vinous* fermentation. Vinegar is of great use in cookery and medicine; the word is derived from the French for wine, *vin*, and *aigre*, sour. The ancients had several kinds of vinegar, which they used as drinks; but it is most likely that these vinegars were different from that so called among us, and were more probably a kind of wine.

Acetous, sour.

Vinous, wine-like.

What materials are used for the dyeing and coloring of our manufactures?

There are many mineral and vegetable earths which furnish mankind with different colors for beautifying their various manufactures, and assisting them in the arts, &c. Some species of insects also come to their aid, as for instance, the cochineals; these insects are killed by the application of heat, and thus form the drug used for giving red colors, especially crimson and scarlet, and for making carmine. The beautiful and permanent blue called Indigo, is the produce of a small shrub, two or three feet in height.

From what part is the Dye obtained?

From the leaves; the color is produced by soaking them some hours in water, in large vessels constructed for the purpose; the sediment of the blue liquor drawn from them is afterwards dried and sold in the form of small grains For the painter, they are mixed with oil, or diluted and made up into small cakes with gum water.

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In what countries is Indigo cultivated?

It is native in both Indies, and in South America, where its cultivation affords employment to many of the inhabitants. It also grows wild in parts of Palestine, and is much cultivated both in Syria and Egypt. It once formed one of the staples of the Southern States, but has in a great measure given way to the cultivation of cotton.

Has Indigo been long known?

The culture and preparation of indigo were known to the Oriental nations long before it was introduced into Europe. The inhabitants of ancient Britain painted their bodies with the blue dye which they obtained from woad, a plant which grows wild in France and along the shores of the Baltic, and which greatly resembles indigo in all its properties, except its brilliancy of color.

Brilliancy, brightness.

What is Gamboge?

The concrete resinous juice of a species of gum-tree, growing in Cambodia, and other parts of the Indies. It is brought over in large cakes or rolls of a yellowish brown color outside, and inside of a deep yellow or orange, which changes to a pale bright yellow on being moistened.

What are the uses of Gamboge?

Dissolved in water, it forms a beautiful and useful color for the painter. It is also used in medicine. Gamboge is soluble in either water or spirits of wine. Mixed with a blue color, it forms green, in various shades according to the different proportions of the ingredients.

What is Logwood?

The wood of a tree which grows in parts of America and the West Indies. It is imported in great quantities, and employed in dyeing purple and the finest blacks.

What is Tar?

A coarse, resinous liquor issuing from the wood and bark of [140]pine or fir-trees; it is in fact the oily juices of the sap thickened and colored by the heat of the sun or by age;

it is extracted for use by burning the wood of the trees under a heavy covering of turf or earth; the tar exudes during the slow combustion, and is collected into a cavity dug in the ground for the purpose. Tar is exported in great quantities from Norway, Sweden, and our Southern States.

What are its uses?

It is applied to the sides of ships and boats and their rigging, to preserve them from the effects of the weather; it is used instead of paint for palings, &c.; and sometimes also in medicine. A kind, called *mineral* tar, is also drawn from coal by the process of distillation. Mineral tar is also found native in some parts of the earth.

What is Pitch?

A kind of juice or gum, likewise drawn from unctuous woods, chiefly those of the pine and fir; it is used for nearly the same purposes as tar in shipping, medicine, and various other arts. Pitch is properly a juice of the wild pine, or pitch tree; it is of a glossy black color, dry brittle, and less bitter and pungent than the liquid tar.

What is Camphor?

A vegetable substance, chiefly procured from a kind of laurel, (Laurus Camphora,) growing in Borneo, Japan, and many East Indian islands; it is also produced from other plants and shrubs, though in very small quantities.

How, and from what part of the tree is it taken?

All parts of the tree are impregnated with camphor; but it is principally extracted from the roots and trunk, by distillation; it is white, and of a crystal form: its odor is extremely fragrant. In this state it is called *rough* camphor, and is thus exported. The Greeks and Romans do not appear to have been acquainted with this valuable drug; and we are indebted to the Arabians for a knowledge of it.

What are the properties and uses of Camphor?

It is a firm, dry, crystal matter, with a hot, sharp, aromatic taste. It is highly odorous, and so inflammable as to burn and preserve its flame in water; it totally vanishes or evaporates in the open air, and in Spirits of Wine it entirely dissolves. Camphor has various uses—as in fire-works, &c.; it is an excellent preservative of animal and vegetable bodies, as it resists worms and other insects. In the courts of Eastern princes it is burnt at night with wax. Its principal use with us is in medicine.

Preservative, a preventive of decay.

What is Musk?

A dry, friable substance of a dark color, taken from a little bag under the belly of a small animal called the Thibet Musk, which is a native of the Indies, Tonquin, and China. It inhabits the woods and forests, where the natives hunt it down. Musk is so strong a perfume as to be agreeable only in the smallest quantities, or when mingled with some other scent; it is used in perfumery, &c.

Is there not another Animal which produces a similar scent?

Yes; an animal of Arabian origin produces an odoriferous substance called Civet, from which it takes its name of Civet Cat; there are several species of this animal which produce it, but it is from the Civet Cat that it is most commonly taken. Civets are found in all the warm parts of Asia and Africa, in Madagascar, and the East Indian Islands. It was formerly in high esteem, but is at present very little used, except to increase the power of other perfumes.

What is Myrrh?

A kind of gum-resin, issuing from the trunk of a tree growing in Arabia, Egypt, and Abyssinia; it flows either naturally, or by incision; and is sent to us in small lumps of a reddish brown or yellow color. Its smell is strong, but not disagreeable. Our myrrh is the same drug that was used by the ancients under [142]the above name. Its chief use now is in medicine. The ancient Egyptians employed it as an ingredient in the embalming of dead bodies.

Embalming, preserving the bodies of the dead from decaying or putrefying, by impregnating them with aromatics and other substances which resist putrefaction.

Where is Abyssinia?

Abyssinia is a large kingdom situated in Eastern Africa.

What is Frankincense?

An odoriferous, aromatic gum-resin, which distils, in the heat of summer, from incisions made in the bark of the tree which produces it: notwithstanding the great use of the gum, both in ancient systems of religious worship and in modern medicine, authors have been much divided in opinion with regard to the kind of tree from which it is obtained; it is a species of turpentine tree belonging to an order of resinous and fragrant trees and shrubs inhabiting the tropical parts of the world.

For what was it formerly used?

The ancients burnt it in their temples as a perfume, and to do honor to the divinities that were worshipped in them: it appears to have been applied to the same purposes by people of all religions. Myrrh and Frankincense were reckoned by the Eastern nations amongst their most costly perfumes. We are informed by St. Matthew's Gospel in the

New Testament, that the wise men who came to Bethlehem to worship our Saviour at his birth, brought gifts of gold, frankincense, and myrrh. Many of the primitive Christians were put to death because they would not offer incense to idols. In the Catholic Church we still retain its use in many ceremonies.

Primitive, early.

Incense, perfumes burnt in religious rites, or as an offering to some deity.

What is the appearance of Frankincense?

It is generally imported in white or yellowish pieces, or drops, [143]which possess a bitter, disagreeable taste; it is very inflammable, and burns with a strong, and pleasant odor. That brought from the Indies is inferior to that from Arabia, and inclines to a reddish color. The common frankincense is softer, more resinous, and possesses less value than the former.

What is Turpentine?

The resinous juice of many trees, as the pine, larch, fir, &c.; it is, in fact, the juice that renders them evergreen, and when in an over-abundant quantity, bursts through their bark, and oozes out. Common turpentine is that procured by incisions from the wild pine; there are several kinds of turpentine procured from various resinous trees; some are of use in medicine, and most of them in making different kinds of varnishes, for preserving and beautifying boxes, paintings, &c.

Ooze, to flow gently.

Is there not a tree more particularly designated the Turpentine Tree?

Yes, the Terebinth or Turpentine Tree of Palestine and the East. It is one of the most common forest trees of those regions, and is regarded with respect and distinction similar to that awarded to the oak in England.

What part of it produces the Gum?

The gum, or rather the resin, distils from the trunk. It is called Cyprus or Chian Turpentine, much of it being brought from the isles of Cyprus and Scio, or Chios, and is procured, by incision, about the month of July. This turpentine, owing to its superior quality, as well as its scarcity, each tree seldom yielding over two or three pounds, is very costly.

Incision, a cutting.

Costly, expensive.

CHAPTER XVI.

BRICKS, MORTAR, GRANITE, SLATE, LIMESTONE, OR CALCAREOUS ROCKS, STEEL, EARTHS, VOLCANOES, AND EARTHQUAKES.

Of what are Bricks composed?

Of clay, dried by the heat of the sun, or burnt in kilns; their color varies with the different degrees of heat to which they are subjected in burning. In the East, bricks were baked in the sun; the Romans used them crude, only laying them to dry in the air for a long space of time.

Crude, in the rough, unbaked state, just as they were formed.

How long have Bricks been in use for building?

Bricks appear to have been in use at a very remote period of antiquity, both from the account of them in the Holy Scriptures, and from the remains of them which have been found; the Tower of Babel and the walls of Babylon were built of them. They were in early use among the Egyptians, as appears from the history of the Jews before their deliverance by Moses. In the book of Exodus, we are told that this captive people were compelled to make bricks for that nation. The Romans, under their first kings, built with massive square stones; but towards the end of the Republic they began to use brick, borrowing the practice from the Greeks; and the greatest and most durable buildings of the succeeding Emperors were composed of them, as the Pantheon, &c.

Massive, bulky and heavy.

By whom was the Tower of Babel erected, and why?

By the descendants of Noe's three sons, Sem, Cham, and Japheth; they were extremely numerous, and dwelt in the land of Sennaar; becoming ambitious of distinguishing themselves, they set about building a tower whose summit might [145]reach to heaven. Sennaar was the original name of the country about Babylon.

Descendants, those descended from a particular person or family.

What remarkable event followed their foolish pride?

The Almighty suddenly frustrated their purpose by confusing their language and causing them all to express their words by different sounds; hence arose the numbers of different languages spoken by the nations of the earth; and thus what they imagined would be a monument of glory, was made an awful memento of their pride and folly.

Frustrated, prevented.

Monument, anything by which the memory of persons or things is preserved.

Memento, a hint to awaken the memory of anything; that which reminds.

What good effect did this event produce?

God, who at all times can bring good out of evil, by this means caused the other parts of the earth to be peopled; for this visitation having effectually broken up their scheme, they emigrated in parties, and dispersed themselves over different parts of the world.

Scheme, plan, intention.

Emigrated, removed from one country to another.

Dispersed, separated.

Where was Babylon?

This celebrated city, so often mentioned in Holy Writ, (and remarkable for the minuteness with which its destruction was foretold by the Prophets,) was the capital of the Assyrian Empire, and situated on the river Euphrates. After the destruction of Nineve, the ancient capital of this empire, Babylon became the most famous city of the East.

Minuteness, particularity.

What is meant by the Assyrian Empire?

The country of Assyria, in Asia.

For what was this city particularly celebrated?

For its hanging gardens, palaces, temples, and walls, the latter of which are said to have been three hundred and fifty [146]feet high, and so broad that six chariots could go abreast upon them. The city was so strongly fortified, both by nature and art, as to be thought impregnable.

Fortified, defended.

Impregnable, incapable of being taken or destroyed by an enemy.

By whom was it destroyed, and when?

By Cyrus, 538 years before the birth of Christ, just fifty years after Nabuchodonosor had destroyed the city of Jerusalem and its temple.

Who was Cyrus?

The founder of the Persian Empire.

Who was Nabuchodonosor?

The King of Babylon.

What was the Pantheon?

A temple of a circular form which was dedicated to all the Gods, or all the Saints. That of all others the most celebrated, is the Pantheon of ancient Rome, and its remains are the most perfect amongst the wonders of that city at the present day.

Circular, having the form of a circle, round.

By whom was it built?

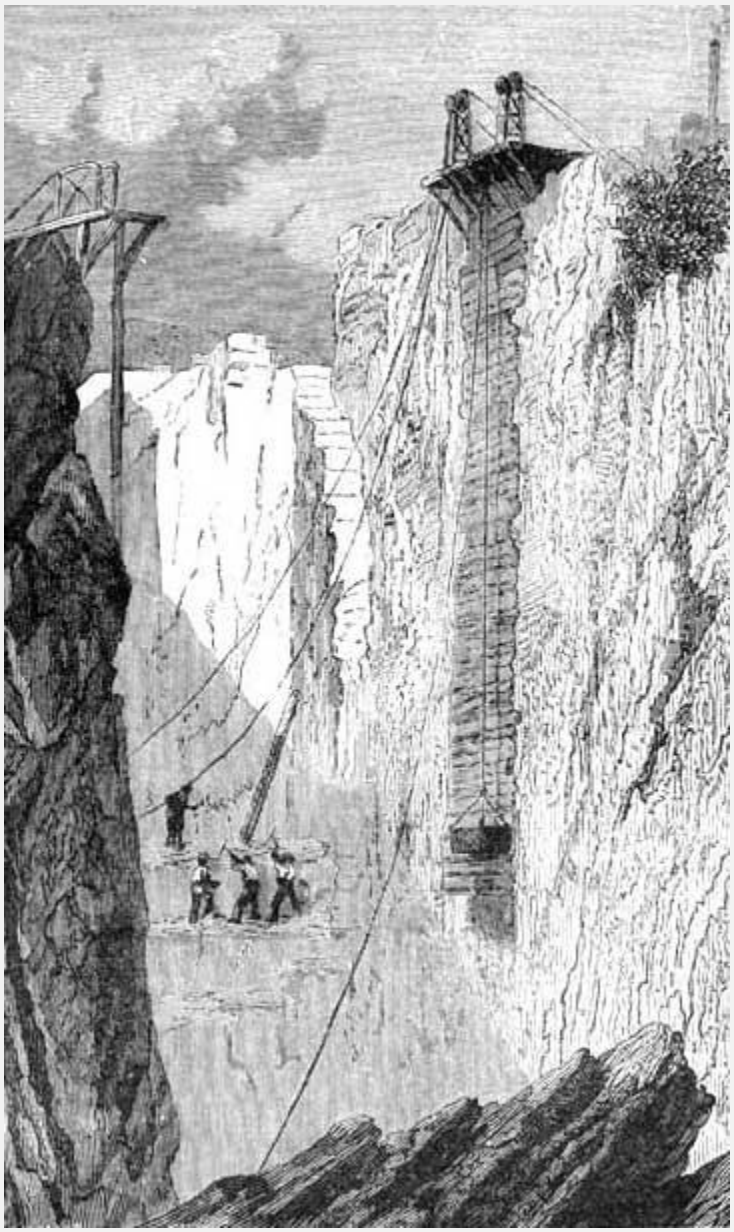
By Agrippa, the Consul of Rome, twenty-five years before Christ; it was dedicated by him to Jupiter: the name Pantheon was given on account of the great number of statues of the Gods ranged in niches all round it; and because it was built in a circular form to represent heaven, the residence of the Gods. It was afterwards converted into a church by Pope Boniface IV, and dedicated to the Blessed Virgin and all the Martyrs, under the title of "Our Lady of the Rotunda." Agrippa likewise built the Pantheon at Athens, which was but little inferior to that of Rome. The Greek Christians afterwards converted it into a church, dedicating it to the Blessed Virgin; but the Turks, when they subdued Greece, changed it into a mosque.

Dedicated, appropriated to a particular person, or to a sacred use.

Residence, dwelling, habitation.

Martyr, one who is put to death for the cause of religion.

Mosque, a Mahommedan temple.



A SLATE QUARRY.

[147]**What is understood by a Consul?**

The chief magistrate of the Roman republic or commonwealth. After the Romans had expelled their kings, they were governed by two Consuls; these were established in the year of Rome 245. The Consuls were the head of the senate; they commanded the armies of the republic, and judged all the differences between the citizens: they held their office for the space of a year; at the end of which time, new ones were elected. Consuls were even continued under the Emperors after the republic was destroyed; but it was then little more than an honorary title, and at last was totally abolished.

Expelled, turned out.

Abolished, annulled, made void.

To what is the term Consul applied at the present time?

To an officer established by a commission from a king or state, to reside in foreign countries of any considerable trade, to facilitate and despatch business, protect the merchants of the state, &c.

Commission, a trust imposed, command, authority.

Facilitate, to render easy.

What is meant by a Senate?

An assembly or council of senators, that is, of the principal inhabitants of a state, who have a share in the government.

What is the government of the United States?

It is one of limited and definite powers, defined by a written constitution.

How are the legislative powers, granted to the government, vested?

In a Congress, consisting of a Senate of two Senators from each state, chosen by the legislature thereof; and a House of Representatives, consisting of one or more members from each state, elected by the people in equal electoral districts.

Legislative, giving or enacting laws

How are our laws made?

Bills passed by the House of Representatives and the Senate, on receiving the sanction of the President, become laws; or, if vetoed by the President, may be passed by two-thirds of both Houses.

Vetoed, withheld assent to.

Who was Jupiter?

The principal deity of the Pagan world.

What is used to cement bricks firmly together?

Mortar; a composition of lime, sand, gravel, &c., mixed up with water; the ancients had a kind of mortar so very hard and binding, that, even to this day, it is next to impossible to separate the parts of some of their buildings.

What is Granite?

A rock which has been formed by the union of three different minerals in a state of fusion; these, on cooling, have crystallized and become distinct from each other in the mass. It is remarkable for the beauty of its colors, its hardness and durability. There are granites of many different colors, as red or rose-colored, grey, green, variegated, &c.

Fusion, a melted state.

Mass, a body, a lump.

What form does it bear?

Granite does not, generally, form one extensive mass, but remains in separate and large fragments, rudely compacted together; besides the three minerals of which it is composed, particles of other stones, or metallic earths, are often accidentally mixed with it. It is called granite from its granulous structure.

Compacted, joined together.

Granulous, consisting of small grains.

Where is Granite found?

Granite occurs in all the larger mountain ranges, and in isolated masses in every country; not being a stratified rock, and being excessively hard, it is difficult to get it out in manageable masses. In Arabia Petræa, the whole country abounds in masses of different granites.

Isolated, alone, separated, detached.

Stratified, consisting of strata or beds.

What mode is usually employed in this country in obtaining it?

Blasting, or blowing up with gunpowder; the force of which detaches pieces from the rock, which are hewn roughly into forms on the spot by a small pickaxe. Granite is also quarried by cutting a deep line some yards long, and placing strong iron wedges at equal distances along this line; these wedges are struck in succession with heavy hammers, till the mass splits down. Another method of detaching masses of rock, is by driving wooden wedges into a deep artificial or natural crack, or fissure; the wedges are then wet, and, in consequence of swelling, burst the rock asunder.

Quarried, from *to quarry*, a term used for the getting of stone from a quarry, or place where stones are dug from the earth, or detached from a large mass of rock.

Detach, to separate.

For what is this Rock used?

On account of its great hardness, it is used for large public structures, as bridges, churches, &c. The ancient temples and other buildings in Egypt, Asia, and Italy, were built of different colored granites, especially the beautiful Oriental red granite.

What is Slate?

The common name for a bluish fossil stone, very soft when dug out of the quarry, and easily cut or split into thin plates,—a property which renders it invaluable for a variety of purposes.

Invaluable, extremely valuable.

For what is it used?

Slate has superseded the use of lead for covering roofs, even of the largest buildings; being lighter and more durable, it is preferable to tile: it is also employed for slabs to form cisterns, shelves for dairies, and other purposes, on account of its strength, coolness, and the ease with which it can be cleaned; the latter [150]quality renders it also of great value in the business of education, as a cheap substitute for paper. The ancients were unacquainted with the use of slate.

What other kinds of stone are used in building?

Limestone, or the calcareous rocks of the geologist: of these there are many varieties. Those which are easily cut and polished are termed marbles, and are used in sculpture and in ornamental architecture. The coarser marbles are used for the common purposes of building.

Calcareous, partaking of the nature of calx or lime,—a term employed to describe chalk, marble, and all other combinations of lime with carbonic acid.

Geologist, one who studies the science of Geology.

Of what do Calcareous Earths or Stones consist?

Calcareous earths, stones, or rocks consist of lime, or pure calcareous earth, carbonic acid, and water.

What is Quick-Lime?

Limestone deprived of its carbonic acid and water by being subjected to an intense heat in a kiln.

How are these Stones wrought?

To whatever purpose the stones are to be applied, the larger blocks obtained from the quarry must be cut into smaller and more manageable pieces by sawing: the saw used is a long blade of steel, without teeth, fixed in a heavy wooden frame. These huge saws are worked by one or two men who sit in boxes to shelter them from the weather; water is caused to drip constantly into the cut, to facilitate the motion of the saw, and keep it cool, so as to prevent it from losing its temper.

Huge, very large.

Temper, hardness; in speaking of metals it signifies the state to which they are reduced, especially with regard to their hardness.

What is Steel?

Iron combined with a small portion of carbon; its chemical name is *Carburet of Iron*. It is not so malleable as iron in its ordinary state; but is much harder, more elastic, and susceptible of a higher polish. Of this material are manufactured knives, [151]swords, and all kinds of cutting instruments and edge tools, used for domestic purposes and in the arts, from the ponderous pit-saw to the finest lancet. Good steel is much more ductile than iron; and a finer wire may be drawn from it than from any other metal. The excellence of edge-tools depends upon their temper.

Ponderous, heavy.

You say that a Geologist is one who studies Geology: what is meant by this term?

A science which enables us to read, in the simple language of nature, the changes which have taken place on the surface of the earth, in its structure and mineral constitution. It describes the different materials and the strata of which the crust of the earth is composed, and investigates the causes of its physical features.

Simple, easily read.

What are Strata?

Layers of rocks and other substances of which the whole earth seems to be composed. These rocks are found lying one above another in regular order; beneath them are the *unstratified* rocks, which seem to form the basis or foundations upon which the others have been deposited. The various layers seem to have been formed during progressive stages of vegetable and animal organization. These rocks and strata are divided into five classes or formations.

Progressive, moving forwards.

Organization, formation or structure of bodies.

Name them.

The Primitive, or lower formations, supposed to have been formed in the chaotic state of the earth, because they have no trace of organized beings or petrifactions; they are chiefly composed of silicious and argillaceous earths, as granite, slate, &c.—Transition rocks, supposed to have been formed during the transition of the earth into a habitable state; they differ from [152]the primitive, in containing the remains of marine animals:—the Secondary rocks, containing the remains of animals and vegetables, and consequently formed after their creation;—the Tertiary formation, composed of layers of clay, sand, gravel, and marl, and containing peculiar organic remains;—and the Alluvial formation, constituted of parts of previous rocks separated by water, &c., and deposited in beds.

Petrifaction, an animal or vegetable substance turned to stone.

Silicious, consisting of flint.

Transition, change from one state to another.

Argillaceous, clayey, consisting of clay.

Chaotic, resembling chaos, confused.

Chaos, confusion, a mingled heap; a term used in speaking of the world while yet without form; a Greek word, signifying a confused mass.

Alluvial, deposited from water.

Of what is this last compounded?

The Alluvial formation is composed of sand, gravel, loam, clay, turf, &c., and contains plants, roots, moss, bones, petrified wood, and skeletons of animals. It is distinguished from the Tertiary formation chiefly by its superior position, and by extending over regions where existing streams or other causes now in action could have produced it. Some geologists mention another formation called the Volcanic, because composed of minerals thrown from the crater of a volcano, such as pumice stones, lava, &c.

Crater, the mouth or opening of a volcano.

Petrified, hardened into stone.

You mentioned Silicious and Argillaceous Earths: is not, then, the earthy covering of our globe of one common character?

No; by earth is understood a combination of many distinct bodies. Chemists, by separating earths from each other, and from foreign matters connected with them, have discovered nine or ten primitive earths; all of these, except silex, are compounds of oxygen with metallic bases.

Chemist, one who understands the science of chemistry.

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Of which of these Simple or Primitive Earths are the solid portions of the globe principally composed?

Of flint or silex, lime or calcareous earth, and clay or argil, in various degrees of combination, the greatest parts of the mountains and plains, and the whole of what we commonly understand by soil, mould, earth, &c. are composed. These, however, though forming nearly all of the solid portions of the world, are constantly mixed with foreign matters, as metals, (particularly iron,) and acids, (as carbonic acid.)

What are the properties of Silex?

Silex, or pure flint, will not dissolve in water, nor can it be melted by itself in any heat; but combined with alkalies, as soda or potash, it forms glass. It is the principal ingredient of most of the precious stones.

What are the chief uses of Silex?

It is the most durable article for the formation of roads; a necessary ingredient in earthenware, porcelain, and cements; and the principal material of glass and vitreous substances. The making of pastes or artificial gems is a branch of the art of glass-making; the basis used is a very hard and pure silex.

Basis, that part of any mixture which is the ground or base; the first principle or element of a substance.

Describe the properties of Lime.

It is of a white color, and possesses a hot, caustic taste. It forms peculiar salts with acids; changes vegetable blues to green; will not fuse; gives out a quantity of caloric when united with water; and absorbs carbonic acid when exposed to air. Lime is very useful in the arts and manufactures, in medicine, &c. The farmers use it as manure to fertilize land.

Caustic, burning, corroding: a term applied to substances which eat away and burn any thing with which they are brought in contact.

In what state is Lime found in nature?

Never native, but combined with other substances;—generally with an acid, and most plentifully with carbonic acid, as in [154]chalk, marble, &c. It is also found in vegetables, and is the basis of animal bones; it likewise occurs in the water of the ocean, and in that of all springs and rivers. The method of procuring *lime*, from chalk, marble, limestone, oyster-shells, &c., has already been described in a former chapter.

What are the properties of Clay?

Argil, or pure clay, also called *alumina*, from its being the basis of alum, is soft to the touch, adhesive, and emits a peculiar odor when moistened;—forms a paste with water, and hardens in the fire. Its uses are so various and important, that it would have been almost impossible for man to have attained his present degree of civilization, if it had not been given him by nature in such abundance. Its uses have already been described in the arts of brick-making, pottery, &c. Besides these three principal primitive earths just described, there are seven others, having several properties in common, yet each possessing its different and specific properties, and evidently designed by nature for different purposes of utility.

Specific, belonging to its particular species.

Utility, usefulness.

What is a Volcano?

An opening in the surface of the earth, or in a mountain, from which are ejected smoke, flames, stones, lava, &c. Beneath the outer crust of the earth inflammable materials appear to exist, which different causes excite into combustion. Volcanoes are supposed to owe their origin to the metals and minerals which form the basis of earths and alkalies; and which, when ignited, expand,—shake the rocky foundations,—and sometimes, bursting through, produce all the destructive effects of earthquakes. They break forth under the sea, as well as the land, and throw up mountains which rise above the level of the water. During an eruption of Vesuvius, A.D. 79, three cities, Herculaneum, Pompeii, and Stabiæ, were overwhelmed, and lay buried beneath the matter ejected from the volcano until within a few years, [155]when excavations were made and many relics discovered;—streets, houses, papyri, (manuscripts,) grain, fruit, bread, medicines, &c. &c., all in a remarkable state of preservation, have been found just as they were left by the terrified inhabitants at the time of the eruption!

Eruption, an issuing or breaking forth with violence.

Ejected, thrown out.

Are there many Volcanoes?

There are upwards of two hundred volcanoes upon the globe; more than one half of them are in America and Oceanica The most noted volcanoes in America are Cotopaxi (the highest in the world), near Quito; Popocatapetl, in Mexico; Cosiguina, and the Water Volcano, in Guatemala. In France, Spain, Portugal, and many other countries, there are districts which show the former existence of volcanoes, which have long been extinct; near Naples, in an area of two hundred square miles, there are sixty craters,

some of them larger than Vesuvius; in one of these, the town of Cumea has stood for three thousand years.

What can you say of new islands formed by Volcanic Agency?

Many examples of new islands rising out of the sea by volcanic action are on record. Some of them are permanent, but others, after a time, disappear. Teneriffe, Iceland, Sicily, St. Helena; part of Sumatra, Java, Japan; and the Sandwich Islands, seem to have been upheaved by volcanic agency; Hawaii, the largest of the last-named group, contains an area of four thousand square miles, and rises eighteen thousand feet above the ocean.

What are Earthquakes?

Shakings or vibrations of the ground; sometimes accompanied by rents, and rockings or heavings of the surface, so as to overthrow buildings, and swallow up towns and large tracts of country. They are attended with a terrible subterranean noise, like [156]thunder, and sometimes with an eruption of fire or water, or else of smoke or winds.

Subterranean, underground.

What is supposed to cause them?

An electrical action between the atmosphere and some deep sub-strata; or the sudden formation of gaseous matter beneath the surface of the earth by internal volcanic fires. Many hot countries, where much electrical disturbance takes place, are very subject to them: earthquakes almost always precede volcanic eruptions; an open volcano, also, probably diminishes the force of earthquakes, by the vent which it affords. Earthquakes, at different times, have been productive of the most terrific effects: towns and cities have been swallowed up, and thousands of people destroyed by them. The island of Jamaica is remarkable for the earthquakes which frequently happen there.

Precede, to go before.

Vent, opening.

Terrific, full of terror, dreadful.

Where is Jamaica situated?

In the West Indies,—a large group of fertile islands which lie between North and South America. Jamaica is the principal one of those which belong to the English.

CHAPTER XVII.

ARCHITECTURE, SCULPTURE, USE OF MONEY, NAVIGATION.

What is meant by Architecture?

The art of building or erecting edifices fit for the habitation of man, to defend him from the weather, and for his domestic comfort and convenience; for devotion, trade, and other purposes, and for the use of civilized life in every capacity.

Capacity, state, condition.

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Is not this an art of great antiquity?

It is almost as ancient as human society; the changes of the seasons first led men to build themselves huts or cabins, into which they might retire for shelter; in process of time, their manner of building gradually improved, and habitations were constructed of more stately forms and elegant proportions, and greater skill and variety were displayed in their ornaments Hence arose the Five Orders or manners of building.

Of what were the first huts composed?

Probably of the branches of trees driven into the ground, and covered with mud and stubble; at length, as men became more expert, they placed trunks of trees upright, and laid others across them to sustain the outer coverings; from this they took the hint of a more regular architecture, and built edifices of brick and stone; the trunks of trees which supported their dwellings gave them a notion of pillars or columns, which they afterwards erected of more durable materials. Among uncivilized tribes at this day, some reside underground, having their dirty dwellings entirely closed during the winter months; in warmer regions, their habitations are built of stakes, leaves, and turf, in the shape of a soldier's tent. In Africa, their kraals or huts are constructed in this manner, but of a circular form, with a hole at the top to let out the smoke. In many of the South Sea Islands, the natives, when first discovered, had progressed still further, having learnt to elevate the roofs on poles, and to fill in the sides of their houses with boughs or rushes, mud or sods.

Probably, most likely.

Edifice, a building.

Notion, idea.

Durable, lasting.

What people are represented by the ancient writers as having brought the art of Building to a greater state of perfection?

The inhabitants of the city of Tyre, to whom Solomon had recourse for workmen to build the Temple. Isaias, in his [158]twenty-third chapter, speaks of the Tyrians and Egyptians, as having brought it to a great degree of magnificence; as may be drawn from the various accounts handed down to us, and the remains of their obelisks, pyramids, &c.

What is an Obelisk?

A very high and slender four-sided pyramid, raised as an ornament in some public place; and frequently covered with inscriptions and hieroglyphics.[16] This kind of monument appears to be very ancient; they were first made use of to declare to posterity the principal precepts of philosophy; to mark the hours of the day by the shadows which they cast on the ground; and, in after-times, to immortalize the actions of heroes, and perpetuate the memory of persons beloved.

[16] See Chapter XIV.

Inscription, something written or engraved.

Hieroglyphics, emblems by which words were implied. They were used before the invention of alphabets.

Implied, signified, denoted.

Posterity, succeeding generations, descendants.

Immortalize, to render immortal,—which means never-dying; to perpetuate the memory of anything.

What is a Pyramid?

A solid, massive edifice, rising from a square, triangular, or other base, gradually diminishing in size till it ends in a point at the top. Like the obelisk, pyramids were sometimes erected to preserve the memory of singular events, or to transmit to future ages the glory and magnificence of princes; but oftener as funeral monuments and receptacles for the dead, particularly kings.

Triangular, three-sided, having three angles.

Diminishing, growing smaller.

Receptacle, the place in which a thing is deposited.

Is it known who were the erectors of these Buildings?

No; it is a curious fact that the Egyptian pyramids, so celebrated for their size and great antiquity, should have the time of their erection and the names of their founders wrapt in such complete mystery. All the different authors who have written [159]concerning them, disagree in their accounts of those who built them, and nothing certain is known of their history.

Founder, one who establishes or erects.

Mystery, profound secresy.

What other nations excelled in the art of Building?

The Greeks and Romans, from whom we derive it, also greatly excelled in this art. Grecian architecture was in its highest glory under Pericles. Among the Romans, it arrived at its greatest perfection under the Emperor Augustus. The five orders of ornamental architecture invented by the ancients, at different times, and on different occasions, are of Grecian and Italian origin. They are the Tuscan, the Doric, the Ionic, the Corinthian, and the Composite; each possessing its peculiar form and beauty, and found in all the principal buildings of the Christian world.

Christian, professing the religion of Christ; the term is applied to those who believe our Lord Jesus Christ to be the only true God and Saviour of the world.

Who was Pericles?

A celebrated Athenian statesman, orator, and general, who gained several victories over the Lacedemonians and other enemies of his country.

Are all the species of ornamental building confined to those nations already mentioned?

By no means; besides the Grecian and Roman orders, other civilized nations possess their separate styles; as the Hindoos, Chinese, Moors, &c.; and nothing can be more grand, harmonious, and picturesque, than each of these in the beautiful specimens which are to be seen in their several countries. The Saxons, also, had a simple style of architecture, distinguished by semi-circular arches, and massive plain columns; the Normans, too, invented a beautiful kind called the Gothic, distinguished by its lightness and the number of its ornaments, and by its pointed arches and pillars carved to imitate several combined together; the Gothic style is found in many old cathedrals.

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Hindoos, inhabitants of Hindostan, in India.

Moors, inhabitants of Morocco, a kingdom of Barbary, in Africa.

Harmonious, corresponding in all its parts with equal beauty and elegance.

Picturesque, like a picture.

Saxons, inhabitants of Saxony, a portion of Germany.

Semi-circular, only half circular.

Describe the Five Orders of Architecture.

The Tuscan (from Tuscany,) is the most simple and devoid of ornament, and its columns or pillars are plain and massive. The Doric (from the Dorians, in Greece,) is durable and noble in appearance, having its columns plain like the Tuscan, but the upper parts more ornamental. The Ionic, (from Iona, in Greece,) is neither so plain as the Doric, nor so richly elegant as the Corinthian; but is distinguished from the first two orders by having its columns or pillars fluted instead of plain, and the upper part of them (called the capitals,) adorned by the figures of rams' horns carved on them. The Corinthian is very rich and delicate, with fluted pillars, and the tops beautifully ornamented with leaves, &c. The invention of this order is ascribed to Callimachus, a Corinthian sculptor. The Composite is compounded of the other four; it is very much like the Corinthian, and is also called the Roman or Italian order.

Devoid, free from, destitute.

What is Sculpture?

The art of cutting or carving wood, stone, and other materials; and forming of them various figures or representations of men, beasts and other objects. The term is mostly limited to carving images or statues in stone. This art is of great antiquity; the sacred writings inform us of it in many passages, as for instance in those in which are mentioned Laban's images, carried away by Rachel; the golden calf of the Israelites, &c. Sculpture as an art is probably more ancient than painting.

What country was the most highly celebrated for its sculpture?

Greece, which produced many celebrated sculptors, of whom [161]the most eminent were Phidias, an Athenian, the great master of this art, who lived in the time of Pericles, 408 years before Christ; Lysippus, a native of Sicyon, near Corinth; and Praxiteles, a native of Magna Grecia.

What event proved fatal to this art?

The death of Alexander the Great was followed by a visible decline in all the fine arts; but the fatal blow to their existence was given by the success of the conquering Romans, who reduced Greece to a Roman province.

Was Sculpture always performed in Stone?

No; at first statues and other figures were formed of wood or baked clay, afterwards of stone, marble and metals; though these last were not brought to any degree of perfection, till about three hundred years before Christ. The Greeks were famous for their works in ivory; the great master of the art of carving statues in it was Phidias.

What progress did the Romans make in Sculpture?

Sculpture, during their early history, existed rather as a plant of foreign growth, partially cultivated by them, than as a native production of their own land. They collected, indeed, some of the most exquisite samples of Grecian sculpture, and invited to their capital the yet remaining sculptors of Greece, by whose labors not only Rome itself was embellished, but also many of the cities of Asia Minor, Spain, and Gaul, then under the Roman dominion; yet the taste for sculpture does not appear to have been cultivated in any measure corresponding with the advantages thus afforded them in the study of the best models of the art. The best works were produced by Greek artists, and chiefly Athenian, while the attempts of the Romans were unskilfully executed.

Gaul, the ancient name of France.

Model, pattern.

Did it always continue thus?

No; from the time of the Emperor Constantine, sculpture, and the rest of the fine arts, gradually revived. While inspired, [162]perhaps, with a taste for sculpture by means of the scattered remains of Grecian art, the Roman artists drew, at the same time, from their own resources, and were by no means servile copyists of the sculptors of a former age. The first academy of the art was founded at Florence, in 1350, and at the close of the same century, sculpture was firmly established in Italy, and itinerant sculptors, not unskilful in their art, wandered from thence to Germany, France, and even to England. The most eminent master of the art was Michael Angelo, born in 1474, who was also a painter and architect; from his time, to the latter end of the last century, sculpture again gradually declined, but under Canova, a native of Possagno, in the Venetian Alps, it revived. He was born in 1757. Besides the above mentioned, were a number of others of various degrees of talent, as well as some still living.

Servile, slavish, mean.

Itinerant, wandering.

When was the knowledge of Sculpture introduced into England?

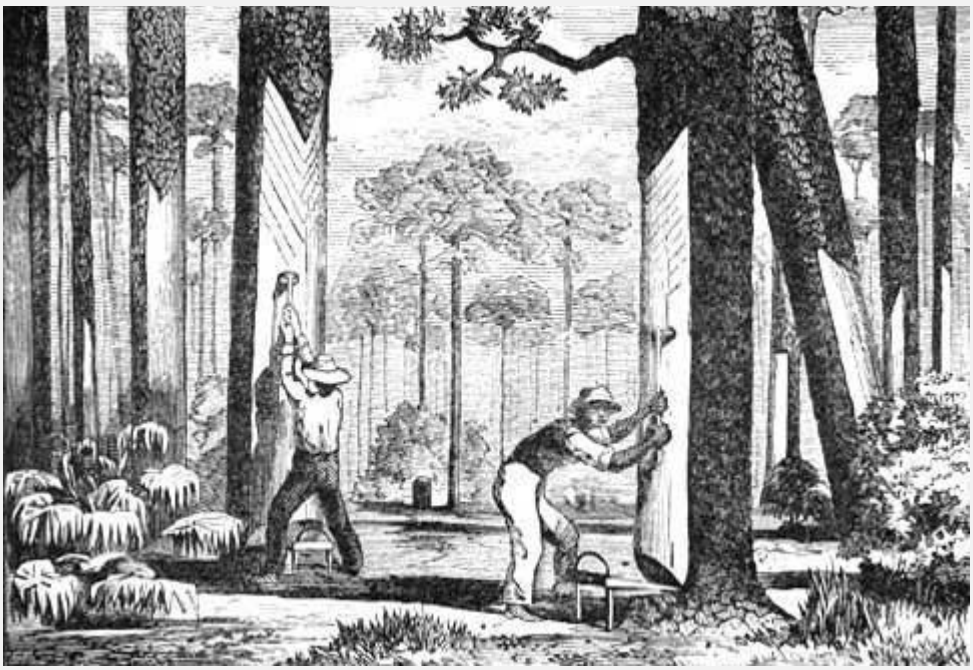
At the time of its conquest by the Romans; but the art appears to have been very rude and imperfect. From the time of the Norman invasion, and still further in the time of the Crusades, an improvement, however, began to show itself in British sculpture. But it is

probable that most of their best architectural and sculptural works were executed by foreigners, members of those societies of wandering sculptors before mentioned. Under Edward the Third, the art appears to have been much cultivated by Englishmen. It is well known that two Italian sculptors were employed in England during the sixteenth century. John of Padua, a pupil of Michael Angelo, was master of works to Henry the Eighth. In the reign of Charles the First, English sculptors flourished, although their works are of a very low order.

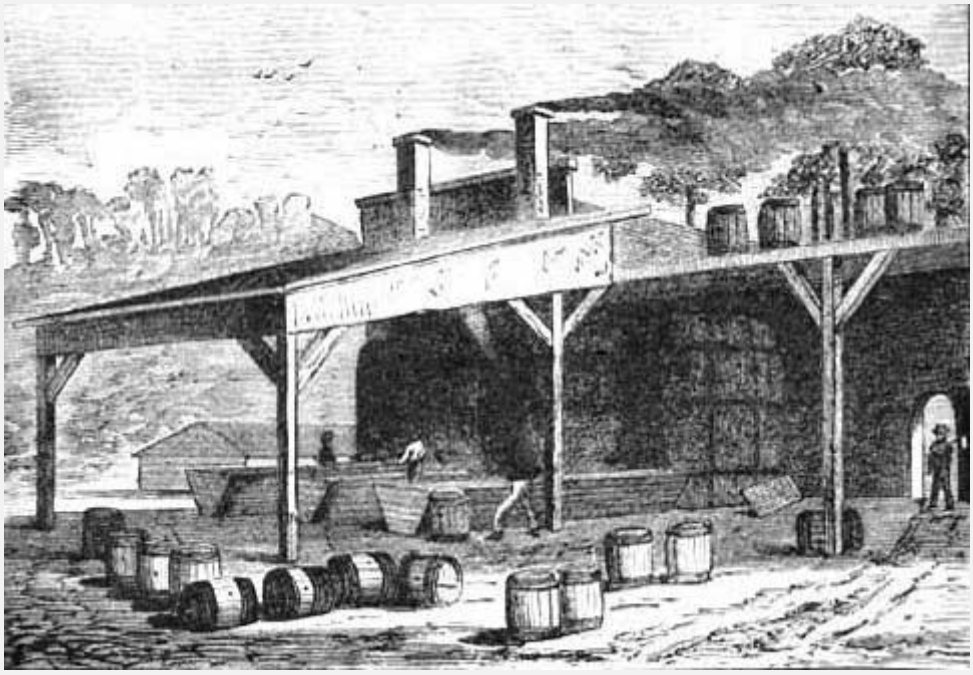
Invasion, hostile entrance upon the rights or possessions of another.

Architectural, belong to Architecture.

Sculptural, belonging to Sculpture.



GATHERING TURPENTINE BY SCRAPING.



DISTILLING TURPENTINE.

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With whom may the School of British Sculptors be considered as commencing?

With Banks, born in 1738, and Bacon, born in 1740; these were in every respect English artists. But the most eminent worker in the art which that country has yet produced, was John Flaxman, born in 1755. Our own country also may boast of sculptors of superior talents, and from the beautiful specimens of the art which have appeared, the attainment of a high degree of excellence in it is to be anticipated.

Attainment, the act of arriving at or reaching.

Anticipated, expected, foreseen.

Give me a short account of this art in Germany, France, and Spain.

In these countries, as in England and the United States, during their early history, many of the best works were executed by Italians. Germany appears to have made little progress in sculpture before the seventeenth century; since that period, it has produced sculptors of some eminence, although it is more celebrated for its writers on the art, than for artists of eminence in its practice. In France, sculptors of some talent are mentioned as early as the sixteenth century. Girardon and Puget were the most celebrated artists of this period. Spanish history gives a long list of native sculptors, from the commencement of the same century, but many of them are but little known beyond their own country. Berruguete, a pupil of Michael Angelo, appears to have

founded the first regular school of the art. Paul de Cespides, and in the eighteenth century, Philip de Castro, were the most eminent among them.

When was the use of Money first introduced?

It is not known with certainty: there is, however, reason to believe that both gold and silver were very early used as money in Egypt and Asia: it was afterwards introduced into Carthage and Greece; whence it was brought to Rome; and from that city spread gradually westward, through all the Roman domin[164]ions. Before the use of money was introduced, the only means of trade was by barter, or the exchange of one commodity for another, a custom long retained by uncivilized nations. In time, however, men discovered the necessity of something which would enable them to trade with greater facility; the first mention of money is in the time of Abraham, who, we are told in the Bible, paid "four hundred sides of silver of common current money," for a burying place.

Current, generally received, passing from hand to hand.

Where was Carthage?

Carthage, now Tunis, was a commercial city, situated on the Northern Coast of Africa, which long contended for the dominion of the Mediterranean with the Romans; but, after three wars, it was taken and destroyed by the Roman general, Scipio Africanus, in the year 251 before Christ.

Commercial, carrying on commerce or trade.

Of what substances was Money usually made?

Of metals, especially the precious metals, because they possess great value in small bulk; may be kept for any length of time without loss; and their value, although not altogether invariable, yet, generally speaking, changes only by slow degrees, and is less susceptible of fluctuation than that of most other articles. At different times, and amongst various nations, however, other things, in the scarcity of metal, have been substituted for it, as shells, wood, leather, paper, or even pasteboard on extraordinary occasions.

Fluctuation, unsteadiness; a wavering.

Of what form was money generally made?

The form of money has been more various than its materials; the ancient Britons used as money, rings or bars of iron or tin; the Lacedemonians used iron bars quenched with vinegar. The money of most nations usually bore an impression peculiar to themselves, as, for instance, the sicle of the Jews was marked [165]with the golden pot of manna on

one side, and Aaron's rod on the other; other coins with the figures of animals, &c.; in shape, coins were either round, irregular, or square.

Have the terms Money and Coin the same signification?

Not exactly; by money is understood any matters, such as metal, wood, leather, glass, horn, paper, fruits, shells, &c., which have currency as a medium in commerce. Coin is a particular species always made of metal, and struck off according to a certain process called coining; it is not of equal antiquity with money. In fact, the very commodities themselves were the first moneys, that is, were current one for another by way of exchange. Coin is a piece of metal converted into money, by the impression of certain marks or figures thereon. The first coining of silver took place at Rome, two hundred and sixty-nine, and of gold, two hundred and six years before Christ: the Romans, after the commonwealth, stamped their coins with the image of the reigning emperor, which custom was followed by most civilized nations. Coins were, and are, frequently, struck in commemoration of a particular event or celebrated person.

When was the use of stamped coin introduced into Britain?

After the arrival of the Romans in that island, the natives imitated them, coining both gold and silver with the images of their kings stamped upon them; but the Romans, when they subdued the nation, suppressed also their coins, and obliged them to use their own; hence the number of Roman coins found among the relics of antiquity in that island.

Suppressed, put aside, hindered from circulation.

Relics, remains.

What does the first coined money in ancient Britain appear to have been?

Copper money; but after the arrival of the Saxons in England, scarcely any copper money was used for many centuries, nor did it become common till 1672; it was first used in Scotland and Ireland in 1340.

What is a Mint?

A place established by public authority for coining money. In the United States, the first mint was in Philadelphia; branches have been established in other parts of the Union. In most countries, the privilege of coining money is regarded as a prerogative of the sovereign power. Formerly, in Great Britain, cities, towns, and even individuals, were allowed to coin money for the convenience of trade; but now this is forbidden, except at the Mint in the Tower of London.

What is meant by Navigation?

The science or art by which the mariner is taught to conduct his ship from one place to another. Some, perhaps, will consider the formation and use of the Ark, as a first step towards the invention of this art; but it is an erroneous idea, because the direction and means for accomplishing this immense work were afforded by God, for the preservation of righteous Noe and his family. Besides, nothing is recorded of any means or of any necessity for its occupants *navigating* it to any particular place, or from one place to another; no intention of this sort is apparent, the ark being merely a vast shelter, rendered capable of floating on the water.

Erroneous, wrong, in error.

Apparent, manifest, made to appear.

What probably gave the first idea of Navigation?

Accident most likely showed that wood always floats; and on the fallen trunk of a tree, perhaps, some one ventured beyond his depth, away from the land. The trunk of a tree, hollowed out, for a more convenient position of the body, formed the canoe, usually found among uncivilized nations to this day. From this rude beginning, at great intervals of time, and a slow pace of improvement, the art has at length arrived at its present state of advancement.

What nation first applied this art to the purposes of Trade?

The Phenicians (especially those of Tyre, their capital city, and Sidon,) were the first who adapted it to the purposes of [167]commerce, and constructed vessels fit to make voyages to foreign countries; the poverty and narrowness of their land, as well as their vicinity to two or three good ports, and their natural genius for traffic, urging them to seek foreign supplies. We hear of them trading to Arabia, India, Persia, Greece, Africa, Spain, and even as far as Britain.

Vicinity, nearness, neighborhood.

Traffic, Trade, commerce.

Who were the Phenicians?

The inhabitants of Phenicia, a country of Syria, in Asia.

Which was the more ancient city, Tyre or Sidon?

Sidon,—having been built, as is supposed, soon after the Flood, by Sidon, the eldest son of Chanaan. Tyre, about 25 miles to the south, was built about the year 1252 before Christ, by a colony from Sidon. The Phenicians planted numerous colonies on the shores of the Mediterranean and the Atlantic, and diffused, to a great extent, among their uncivilized neighbors the arts and improvements of civilized life. One of their most

celebrated colonies was that founded by them on the northern coast of Africa; and it was this colony that built the famous city of Carthage.

Diffused, spread abroad, scattered.

Did not Carthage afterwards become as flourishing as the parent city of Tyre?

In time, Carthage not only equalled Tyre itself, but surpassed it,—pursuing the course the Phenicians had begun, and sending its merchant fleets through Hercules' Pillars, (now the Straits of Gibraltar,) along the western coast of Africa, and northwards, along the coast of Europe, visiting particularly Spain, Gaul, &c. They even undertook voyages, the sole object of which was to discover new countries and explore unknown seas. The Carthaginians appear to have been the first who undertook voyages solely for the sake of discoveries.

Were not both these celebrated cities destroyed?

Tyre, whose immense riches and power were the subject of [168]many ancient histories, was destroyed by the Grecian Emperor Alexander the Great, and its navigation and commerce transferred by him to Alexandria, a new city which he meditated making his capital. Alexandria, in a short time, became the most important commercial city in the world. Thus arose navigation among the Egyptians; it was afterwards so successfully cultivated by them, that Tyre and Carthage (which last, as before mentioned, was subdued by the Romans,) were quite forgotten.

Transferred, removed.

Capital, chief city or town in a state or kingdom.

Who was Alexander the Great?

The son of Philip, King of Macedonia, in Greece; he was celebrated for his great ambition, and the number of his conquests; he overturned the Persian empire, and subdued many cities and provinces in the East.

Did not Alexandria undergo the same fate as Tyre and Carthage?

Egypt was at last reduced to a Roman province, after the battle of Actium, and its trade and navigation fell into the hands of the Emperor Augustus, in whose time Alexandria was little inferior to Rome; and the magazines of the capital of the world were supplied with merchandise from the capital of Egypt. Alexandria, however, at last underwent the fate of Tyre and Carthage, being surprised by the Saracens, who overran the northern parts of Africa; and though it continued, for a while, to enjoy a considerable portion of the commerce of the Christian merchants, it afterwards remained in a languishing condition: but still, even at this day, it is a place of considerable trade.

Who were the Saracens?

A Mahommedan nation, occupying a portion of what is now called Arabia. They extended their conquests over a large portion of Asia, northern Africa, and Spain. Their name is derived from the word *Sara*, a desert.

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What effect had the Fall of the Roman Empire on Navigation?

The fall of the Roman empire not only drew along with it its learning and the polite arts, but also the art of navigation; the Barbarians, into whose hands the empire fell, contenting themselves with enjoying the spoils of those whom they had conquered, without seeking to follow their example in the cultivation of those arts and that learning which had rendered Rome and its empire so famous.

What other people, about this period, distinguished themselves in the art of Navigation?

The Saracens or Arabians, whose fleets now rode triumphant in the Mediterranean; they had taken possession of Cyprus, Rhodes, and many of the Grecian islands, and extended their commerce and their discoveries in the East, far beyond the utmost knowledge of their ancestors.

What other circumstance also prevented commercial intercourse from ceasing altogether?

Constantinople, though often threatened by the fierce invaders, who spread desolation over Europe, was so fortunate as to escape their destructive rage. In this city, the knowledge of ancient arts and discoveries was preserved; and commerce continued to flourish there, when it was almost extinct in every other part of Europe.

Desolation, destruction, ruin.

Did the citizens of Constantinople confine their trade to the Islands of the Archipelago, and the adjacent coast of Asia?

No, they took a wider range; and, following the course which the ancients had marked out, imported the productions of the East Indies from Alexandria. When Egypt was torn from the Roman Empire by the Arabians, the industry of the Greeks discovered a new channel by which the productions of India might be conveyed to Constantinople.

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Did not the Barbarians, after a while, turn their attention to Navigation and Commerce?

No sooner were the brave among these nations well settled in their new provinces—some in Gaul, as the Franks; others in Spain, as the Goths; and others in Italy, as the Lombards,—than they began to learn the advantages of these arts, and the proper methods of managing them, from the people they had subdued; and that with so much success, that they even improved upon them, and set on foot new institutions for their advantage. To the Lombards, in particular, is usually ascribed the invention and use of banks, book-keeping, and exchanges. Thus the people of Italy, and particularly those of Venice and Genoa, have the glory of restoring to Europe the advantages that had been destroyed by their own ravages.

Institutions, laws, regulations.

Exchange, a species of mercantile transactions by which the debts due to persons at a distance are paid by order, draft, or bill of exchange, without the transmission either of money or goods.

Who were the Franks?

A people who settled in Gaul; from them it took the name of Franconia, or France.

Who were the Goths?

An ancient people, who inhabited that part of Sweden called Gothland; and afterwards spread themselves over great part of Europe.

Who were the Lombards?

The Lombards, or Longobardi, were, like the Franks, a nation of Germany; who, upon the decline of the Roman Empire, invaded Italy, and, taking the city of Ravenna, erected a kingdom.

Where is Ravenna?

In Central Italy. It is the capital of a province of the same name; it is an ancient town, and the see of an archbishop.

See, the seat of episcopal power; the diocese of a bishop.

Episcopal, belonging to a bishop.

Archbishop, the presiding bishop of a province.

THE GRAND CANAL, VENICE, ITALY.

What was the origin of the city of Venice?

In the Adriatic Sea were a great number of marshy islands, separated only by narrow channels, but well screened and almost inaccessible, inhabited by a few fishermen. To these islands the people of Veneti (a part of Italy, situated along the coasts of the gulf,) retired when Alaric, King of the Goths, ravaged Italy. These new Islanders, little imagining that this was to be their fixed residence, did not, at first, think of forming themselves into one community, but each of the 72 islands continued a long while under its respective masters, and formed a distinct commonwealth.

Adriatic Sea, a name given to the Gulf of Venice.

Commonwealth, a republic, a government in which the supreme power is lodged in the people.

What circumstance caused them to unite?

Their commerce becoming considerable enough to awaken the jealousy of their neighbors, they united in a body for their mutual protection: this union, first begun in the 6th century and completed in the 8th, laid the foundation of the future grandeur of the state of Venice. From the time of this union, fleets of their merchantmen sailed to all the ports of the Mediterranean; and afterwards to those of Egypt, particularly to Cairo, a new city, built by the Saracen princes, on the banks of the Nile, where they traded for spices, &c. The Venetians continued to increase their trade by sea and their conquests on land till 1508, when a number of jealous princes conspired against them

to their ruin; which was the more easily effected in consequence of their East Indian commerce, of which the Portuguese and French had each obtained a share.

Conspired, united together in a plot.

What is the signification of Mediterranean?

Inclosed within land, or remote from the ocean. It is more particularly used to signify the sea which flows between Europe and Africa.

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Had not Venice a formidable rival in a neighboring republic?

Genoa, which had applied itself to navigation at the same time with Venice, and with equal success, was long its dangerous rival, disputed with it the empire of the sea, and shared with it the trade of Egypt, and other parts, both of the East and West. Jealousy soon broke out; and, the two republics coming to blows, there was almost continual war between them for three centuries: at length, towards the end of the 14th century, the strife was ended by the fatal battle of Chioza; the Genoese, who till then had usually the advantage, lost all, and the Venetians, almost become desperate, at one decisive blow, beyond all expectation, secured the empire of the sea and their superiority in commerce.

Decisive, final, conclusive.

Where is Genoa situated?

In the north-western part of Italy. It was formerly a flourishing republic, but belongs now to Italy.

What event likewise contributed to the more rapid progress and diffusion of Navigation and Commerce?

The Crusades: for the Genoese, Pisans, and Venetians, furnished the fleets which carried those vast armies, composed of all the nations of Europe, into Asia, upon this wild undertaking, and also supplied them with provisions and military stores. Other travellers, also, besides those whom religious zeal sent forth to visit Asia, ventured into remote countries, from motives either of commercial advantage, or those of mere curiosity.

Zeal, devotion, enthusiasm.

Who were the Pisans?

Inhabitants of Pisa, an ancient town of Tuscany; it was once a great independent republic, and is still adorned with noble edifices. Pisa has long been celebrated for its

remarkable leaning tower. Tuscany is a beautiful and fruitful territory of Italy; its capital, until the year 1859, was Florence.

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What were the Crusades?

Holy wars, or expeditions, undertaken by the Christians against the Turks and Saracens, to recover Palestine, between the years 1100 and 1400.

What causes led to these wars?

Many circumstances contributed to give rise to them. They were undertaken, first, with a view to protecting the devout Christian pilgrims, who were in the habit of frequenting the venerable places where our Saviour had lived, taught, suffered, and triumphed, from the fury and avarice of the heathens; secondly, with a view to getting possession of the Holy Land itself, and of annexing it to Christendom; and thirdly, to break down the power of Mohammedanism, and to elevate the Cross in triumph and victory over Palestine.

Avarice, an excessive desire of gain.

Annexing, adding, joining.

What badge or sign was worn by those who engaged in the Crusades?

They distinguished themselves by crosses of different colors, worn on their clothes; from which they took the name of Croisés, or Cross-bearers; each nation wore different colors: for instance, the English had white crosses, the French red, and so on.

To what invention is the art of Navigation much indebted?

To that of the Mariner's Compass, in the beginning of the 14th century; and from this period may be dated the present perfection of this useful art.

You have given me an account of the restoration of Navigation in Southern Europe: did not the inhabitants of the North also turn their attention to it?

Yes: about the same time, a new society of merchants was formed in the northern parts, which not only carried commerce to the greatest perfection of which it was capable, till the dis[174]covery of the Indies, but also formed new codes of useful laws for its regulation.

Codes, books or writings setting forth certain laws or rules respecting particular subjects; books of civil laws.

Are Navigation and Commerce inseparably connected with each other?

It may be considered as a general maxim, that their union is so intimate, that the fall of one inevitably draws after it that of the other; and that they will always either flourish or decline together may be seen, by examining the reason of their passing successively from the Venetians, Genoese, &c., to the Portuguese and Spaniards, and from them to the English, Dutch, &c.

Maxim, rule, an established principle.

Intimate, close.

Inevitably, without possibility of escape, unavoidably.

CHAPTER XVIII.

MUSIC, PAINTING, POETRY, ASTRONOMY, ARTS AND SCIENCES, ART OF WRITING, AND CHEMISTRY.

What are the earliest accounts of Musical Instruments on record?

The earliest accounts of music which we possess are to be found in the Bible, in which the state of the world before the flood is noticed. Jubal is said to have been "the father of them that play upon the harp and organ;" but it is not to be supposed that these instruments at all resembled the harp and organ of modern times. Musical instruments, in the times of David and Solomon, were used in religious services; and music was certainly employed by the Jews on many other occasions, as at funerals and weddings, at harvest home, and at festivals of all kinds.

Modern, opposed to ancient, pertaining to the present time, or time not long past.

Festival, a rejoicing, a feast, a season dedicated to mirth.

What nation was particularly celebrated for musical talents?

The ancient Egyptians; who were so celebrated for their talents in music, that the distinguished philosophers of Greece braved many dangers, in order to study the science in Egypt; and this, at a period when the Egyptians were far from being in the same high state of civilization as their forefathers had been in earlier times. The history and monuments of ancient Egypt have many accounts and representations of musical instruments, and remains of these have lately been discovered, so that we have ocular demonstration both of their existence and form.

Civilization, freedom from barbarity, polish, politeness, possession of knowledge and the arts of life.

Ocular, known or seen by the eye.

Demonstration, the act of proving with certainty.

In how many divisions may musical instruments be arranged?

There are three kinds, namely, *wind* instruments, as the trumpet, and the organ;—*stringed* instruments, as the harp or lyre, violin, &c.; and instruments of *concussion*, in which the sound is produced by striking a sonorous body, as for instance the drum, bells, &c.

Which of these three kinds was the first invented?

It is impossible, at the present day, to decide which; but it is most probable that instruments with strings were the last invented of the three kinds; and it is most likely, that of those in which sound is produced by the application of wind, the trumpet or horn was first used. This instrument, in its rudest form, was ready fashioned to the hand of man; the horn of a ram or of an ox, or some of the larger kinds of sea-shells, were soon discovered to possess the power of producing sound, by being blown into through a small hole at the pointed end.

What improvement in this instrument would naturally follow?

Mankind having discovered the property possessed by a hollow tube of producing a certain sound, soon found that the note varied according to the length and capacity of the tube. A much greater improvement soon after took place; it was discovered that one tube answered the purpose of many by boring holes in the course of its length, and producing various musical sounds by stopping with the fingers certain of these holes. Most of our modern wind instruments are but improvements on the ancient inventions.

Tube, a pipe; a long hollow body.

Was not Vocal Music used before the invention of Instrumental?

Vocal music, namely, that produced by the human voice, (so called to distinguish it from *instrumental*, that produced by instruments,) was undoubtedly the first: for man had not only the various tones of his own voice to make his observations on, before any art or instrument was found out; but the various natural strains of birds to give him a lesson in improving it, and in modulating the sounds of which it is capable.

Modulating, forming sound to a certain key.

To what circumstance did an ancient poet ascribe the invention of stringed instruments?

To the observation of the winds whistling in the hollow reeds. As for other kinds of instruments, there were so many occasions for cords or strings, that men were not long in observing their various sounds, which might give rise to stringed instruments. Those of concussion, as drums and cymbals, might result from the observation of the naturally hollow noise made by concave bodies when struck.

What are the most ancient stringed instruments?

The most ancient instruments of this kind, whose form is known, are those of the ancient Egyptians; among these the harp stands pre-eminent. One of the most celebrated representations of an Egyptian harp was drawn from a painting disco[177]vered in one of the caverns in the mountains of Egyptian Thebes, by some travellers: it is called the Theban harp, and has thirteen strings; its form is extremely elegant. This harp is supposed to be one of the kind in use before and at the time of Sesostris. Remains of Egyptian harps of a more simple construction, with only four strings, have likewise been discovered. Among the monuments of ancient Rome, there are representations of stringed instruments resembling the harp, but not equal in beauty of form to the famous Egyptian harp already mentioned.

Pre-eminent, surpassing others.

Who was Sesostris?

A King of Egypt, who is said to have reigned some ages before the siege of Troy. He appears to have been celebrated for his conquests, and for the number of edifices he erected to perpetuate his fame.

Perpetuate, to preserve from extinction; to continue the memory of a person or event.

Where was Troy?

Troy, anciently called Ilium, was the capital of Troas, in Asia. It became famous for the ten years' siege it sustained against the Greeks; the history of this event is commemorated in the poems of Homer and Virgil.

Is not the harp an instrument of high antiquity in Great Britain?

Yes: it was a favorite instrument with the ancient Saxons in Great Britain. The celebrated Alfred entered the Danish camp disguised as a harper, because the harpers passed through the midst of the enemy unmolested on account of their calling. The same deception was likewise practised by several Danish chiefs, in the camp of Athelstan, the Saxon. The bards, or harpers of old, were the historians of the time; they handed down from generation to generation the history of remarkable events, and of the deeds

and lineage of their celebrated chiefs [178]and princes. The harpers of Britain were formerly admitted to the banquets of kings and nobles: their employment was to sing or recite the achievements of their patrons, accompanying themselves on the harp. No nations have been more famous for their harps and harpers than the Welsh and Irish.

Recite, to repeat or chant in a particular tone or manner.

Achievement, a great or heroic deed.

Patron, benefactor, one who bestows favors.

What instrument was famous among the ancient Greeks?

The Lyre: the invention, or rather discovery, of this instrument is ascribed by them to their most celebrated deities. It is supposed to have originated from the discovery of a dead tortoise, the flesh of which had dried and wasted, so that nothing was left within the shell but sinews and cartilages: these, tightened and contracted, on account of their dryness, were rendered sonorous. Some one, Mercury or Apollo, they affirm, in walking along, happening to strike his foot against the tortoise, was greatly pleased with the sound it produced: thus was suggested to him the first idea of a lyre, which he afterwards constructed in the form of a tortoise, and strung with the dried sinews of dead animals. The stringed instruments already described were made to give out musical sounds, by causing a vibratory motion in their strings by means of the fingers.

Sinew, a tendon; that which unites a muscle to a bone.

Cartilage, a gristly, smooth, solid substance, softer than bone.

Vibratory, shaking.

Who was Mercury?

The heathen god of eloquence, letters, &c., and the messenger of the other gods.

Who was Apollo?

The god of music, poetry, medicine, and the fine arts.

PICKING COTTON.

GATHERING TEA.

What is a Tortoise?

A well-known animal, with a thick shelly covering, belonging to the order of reptiles; there are two species, the sea and the land tortoise; the first named is called a turtle, and affords delicious food; land tortoises live to a very great age. It is only [179]one sort which furnishes the beautiful shell so much prized. Tortoises are found in many parts of the world. The turtles on the Brazilian shore are said to be so large as to be enough to dine fourscore men: and in the Indian sea, the shells serve the natives for boats.

Of what are the strings of the Lyre, &c., composed?

Sometimes of either brass or silver wire, &c., but most commonly of catgut.

What is Catgut?

The intestines of sheep or lambs, dried or twisted, either singly or several together. Catgut is also used by watch-makers, cutlers, and other artificers, in their different trades. Great quantities are imported from France and Italy.

Are there no other kind of Instruments besides those already described?

Yes, music and musical instruments have progressively improved; and it would be a needless task to enumerate the numbers of instruments of each kind now in use; many, as for instance the organ, the piano, musical boxes, &c., are exceedingly complex and ingenious in their construction, as well as remarkable for the sweetness of their various sounds; some, as the two first-named, are played with the fingers, and produce any melody or combination of sound at the will of the performer; others, as the musical-box, barrel-organ, &c., produce a particular melody, or a certain number of melodies, by means of machinery. In the use of the last-named the performer is not at all indebted to his own musical skill, as he has only to turn the handle which sets the machinery in motion, and the musical box, or barrel-organ, will continue playing till it has finished the tunes to which it is set.

Upon what principle do these last-mentioned instruments perform?

The barrel-organ and musical box both play on nearly the same principle, though the former is turned by a handle, and [180]the latter only requires a certain spring to be touched, in order to set it off or to stop it. Their machinery consists of a barrel pricked with brass pins; when the barrel revolves, these ping lift a series of steel springs of different lengths and thicknesses, and the vibration of these springs when released, produces the different notes.

What is Painting?

The art of representing objects in nature, or scenes in human life, with fidelity and expression, either in oil or water colors, &c.

Fidelity, truth, faithfulness.

Oil Colors, those colors which are mixed up with oil, as the others are with water.

Is not this art of great antiquity?

There is not the slightest doubt of it; but to name the country where it was first practised, or the circumstances attending its origin, is beyond the power of the historian. About a century after the call of Abraham, Greek and Egyptian tradition tells us of a colony planted at Sicyon, by an Egyptian, who brought with him the knowledge of painting and sculpture, and founded the earliest and purest school of Greek art. The walls of Babylon were adorned with paintings of different kinds of animals, hunting expeditions, combats, &c. Allusions to this custom of the Babylonians, of decorating their walls with paintings, are found in the Bible.

Tradition, a history or account delivered from mouth to mouth without written memorials; communication from age to age.

Allusion, reference.

Decorating, ornamenting.

Sicyon, a kingdom of Peloponnesus, in ancient Greece.

Were the Egyptians acquainted with this art?

It is now little doubted that, although painting and sculpture existed in Egypt, and were probably at their highest condition, eighteen centuries before the Christian era, yet, at a still earlier period, these arts were known in the kingdom of Ethiopia; and it is considered likely, that the course of civilization descended from Ethiopia to Egypt. There is, however, no record of any [181]Egyptian painter in the annals of the art; and it does not appear that it ever flourished in that country, or that other nations were much indebted to Egypt for their knowledge of it.

Era, age, period.

Ethiopia, the ancient name of the kingdoms of Nubia and Abyssinia, in Africa.

Annal, record, history.

Exploit, action, achievement, deed of valor.

Have we any notice of this art among the Hebrews?

There is no allusion made to the existence of painting among this people, and no proof that it was cultivated among them: it is supposed that the neglect of this art arose from their not being permitted to represent any object by painting.

What progress did the generality of the Eastern nations make in this art?

The art of painting among the Phenicians, Persians, and other Eastern nations, advanced but slowly. The Chinese appear, until a very recent period, to have contented themselves with only so much knowledge of the art as might enable them to decorate their beautiful porcelain and other wares; their taste is very peculiar, and though the pencilling of their birds and flowers is delicate, yet their figures of men and animals are distorted, and out of proportion; and of perspective they seem to have but little idea. Latterly, however, a change has taken place in Chinese art, and proofs have been given of an attempt to imitate European skill. The Japanese figures approach more nearly to beauty of style than Chinese productions of a similar kind.

Distorted, having a bad figure.

Perspective, the science by which things are represented in a picture according to their appearance to the eye.

Who are the Japanese?

The inhabitants of Japan, an empire of Eastern Asia, composed of several large islands. They are so similar in feature, and in many of their customs and ceremonies, to the Chinese, as to be regarded by some, as the same race of men. The Japanese language is so very peculiar, that it is rarely under[182]stood by the people of other nations. Their religion is idolatrous; their government a monarchy, controlled by the priesthood. The people are very ingenious, and the arts and sciences are held in great esteem by them. In all respects, Japan is an important and interesting empire.

Monarchy, a government in which the power is vested in a king or emperor.

By what nations was the art of painting practised with great success?

By the Greeks and Romans. Greece produced many distinguished painters, among whom Apelles was one of the most celebrated; he was a native of Cos, an island in the Archipelago, rather north of Rhodes; he flourished in the time of Alexander the Great, and witnessed both the glory and the decay of ancient art: the leading features of his style were beauty and grace. But painting was not at any period so completely national in Greece, as sculpture, its sister art; the names of one hundred and sixty-nine eminent sculptors are recorded, while only fifteen painters are mentioned. Zeuxis, of Heraclea, was another famous Greek painter, who flourished 400 years before Christ. The Romans were not without considerable masters in this art, in the latter times of the republic, and under the first emperors.

What nation is supposed to have known and practised this art even before the foundation of Rome?

The Etruscans, inhabitants of Etruria, whose acquaintance with the arts has excited great astonishment among those who have most deeply searched into their history, and traced

their progress by means of the beautiful specimens of their works still extant. Their early works were not superior to those of other nations; but either from their intercourse with Greece, or the original genius of the people, they had attained considerable eminence in the arts of painting, sculpture, &c., before Rome was founded. Pliny speaks of some beautiful pictures at Ardea [183]and Lanuvium, which were older than Rome: and another author also says that before Rome was built, sculpture and painting existed among them.

Where was Etruria situated?

In Italy, on the west of the Tiber, which separated it from the territory of ancient Rome, to which it was afterwards annexed by conquest. Etruria was the ancient name of Tuscany.

Annexed, united.

Was not the art greatly obscured for some centuries?

The irruption of Barbarians into Italy and Southern Europe, proved fatal to painting, and almost reduced it to its primitive state; it was not until after a long period that it was fully restored. The first certain signs of its revival took place about the year 1066, when Greek artists were sent for to adorn several of the cities of Italy. Cimabue, a native of Florence, in the thirteenth century, caught the inspiration of the Greek artists, and soon equalled their works. He was both a painter and an architect.

Irruption, inroad, invasion.

To what did this revolution in its history give rise?

It caused it to be distinguished into ancient and modern. The ancient painting comprehends the Greek and Roman: the modern has formed several schools, each of which has its peculiar character and merit. The first masters who revived the art were greatly surpassed by their scholars, who carried it to the greatest state of perfection, and advanced it not only by their own noble works, but also by those of their pupils.

Who were the principal masters of the Italian school?

Raphael and the celebrated Michael Angelo Buonarotti; the former is regarded as the prince of modern painters, and is often styled "the divine Raphael;" he was born at Urbino, in 1483. Michael Angelo was born at Florence, in 1564, and united the professions of painter, sculptor, architect, poet, and musician. Besides these there were many other illustrious Italian painters, [184]the principal of whom were Leonardo da Vinci, Titian, Correggio, the three Caracci, Guido, Parmegiano, Salvator Rosa, &c.

Was not Raphael also reckoned as excellent an architect as he was a painter?

He was not only esteemed the best painter in the world, but also the best architect; he was at least so admired for skill and taste in architecture, that Leo the Tenth charged him with the building of St. Peter's Church at Rome.

Who was Leo the Tenth?

A great Pope, who was an ardent lover and patron of learning and the arts. He was born at Florence, in 1475, and died in 1521.

Give me a list of some of the most celebrated painters besides those already mentioned.

The great painters of the *German* school were Albert Durer, Holbein, Kneller and Mengs, with several others.

Of the *Dutch* school, were Rembrandt, Gerard Dow, Mieris, Ostade, Polemberg, Berghem, and Wouvermans.

Of the *Flemish*, Rubens, Teniers, Jordaens, and Vandyck.

The admired painters of the *French* school, were Claude, Poussin, Le Brun, and many others.

The *Spaniards* also have had their Murillo, Velasquez, &c.

The *English*, Hogarth, Wright, Reynolds, Wilson, Northcote, Gainsborough, Morland, Barry, and others.

The *Americans*, Washington Allston, Benjamin West, Gilbert Stuart, John Singleton Copley, John Trumbull, G. Stuart Newton, Thomas Cole, Henry Inman, and a number of others; besides many now living, or but recently deceased.

Upon what materials did the ancients paint their works?

Principally upon wood; the boards or tables were prepared with a thin ground of chalk and size of some kind. Linen cloth or canvas was also employed, but there is no evidence of its use before the reign of Nero. Parchment, ivory and plaster were the other materials.

Evidence, testimony, record.

Who was Nero?

One of the Roman Emperors, a monster of cruelty, extravagance, and debauchery; he raised a dreadful persecution against the Christians, in which St. Paul was beheaded,

and St. Peter crucified. At last, being deserted by his army and the senate, he destroyed himself, after a reign of fourteen years.

Debauchery, wickedness.

What is Poetry?

The glowing language of impassioned feeling, generally found in measured lines, and often in rhyme. Most ancient people had their poets.

Glowing, warm, energetic.

Impassioned, full of passion, animated.

Rhyme, the correspondence of the last sound of one verse to the last sound or syllable of another.

Name a few of the ancient poets.

David was an inspired poet of the Hebrews: Homer, one of the earliest poets of the Greeks: Ossian, an ancient poet of the Scots: Taliesen, an ancient poet of the Welsh: and Odin, an early poet of the Scandinavians.

Who were the Scandinavians?

The inhabitants of Scandinavia, the ancient name of Denmark, Sweden, and Norway.

What people are regarded as the Fathers of Poetry?

The Greeks. Homer was the first and the prince of poets; he celebrated the siege of Troy in the Iliad and Odyssey, two epic poems which have never been surpassed. In the same kind of composition he was followed, nine hundred years after, by Virgil, in the Eneid; by Tasso, after another fifteen hundred years, in the 'Jerusalem Delivered.' The Greeks also boasted of their Pindar and Anacreon in lyric poetry; and of Aristophanes, Euripides, Sophocles, and Eschylus, in dramatic poetry.

Did the Romans possess any distinguished Poets?

Yes; among the epic poets were Ovid and Tibullus; among [186]dramatists, Plautus and Terence; of didactic and philosophic poets, Lucretius, Virgil, Horace, and Silius Italicus. All these were so many miracles of human genius; and their works afford the models of their respective species of composition. Most of the works of the ancients have in sentiment, if not in spirit, been translated into English.

Miracles, wonders.

Genius, natural talent.

Respective, particular.

Sentiment, thought, meaning.

Did not the same revolution which undermined the Greek and Roman empires, and destroyed learning, the arts and sciences, and the taste for elegance and luxury, also prove fatal to Poetry?

It did; the hordes of barbarians who overran Europe wiped out civilization in their progress, and literature, art, and science fled before the wild conquerors to find a refuge in the monastery and the convent. Here knowledge was fostered with the love and ardor which religion alone can impart. Finally, when the rude barbarians were converted, it was to the religious Orders that the world turned for the establishment of schools, and it is to the Church alone, in the person of her popes, her bishops, and her monks that we are indebted for the preservation of learning, and its revival in the fifteenth century.

What celebrated Poets marked this revival?

In Italy, Dante, Ariosto, Petrarch and Tasso. These were followed, in France, by Racine, Corneille, Boileau, Voltaire, La Fontaine and Delille; in England, by Chaucer, Spenser, Shakspeare, Milton, Dryden, Pope, Thomson, Young, Collins, Gray, Byron, Coleridge, &c; in Scotland, by Sir Walter Scott; in Ireland, by Thomas Moore; in Germany, Klopstock, Goethe and Schiller.

Name some of the distinguished poets of our own country.

Henry Wadsworth Longfellow, William Cullen Bryant, James Russell Lowell, John G. Whittier, Fitz-Greene Halleck, [187]and many others whose meritorious works will be impartially judged by a future age.

Impartially, justly, without prejudice.

Name the different kinds of Poetry.

Epic, or historical; dramatic, or representative,—from drama, the name of all compositions adapted to recitation on the stage—in which are displayed, for instruction and amusement, all the passions, feelings, errors, and virtues of the human race in real life; lyric poetry, or that suited to music, as songs, odes, &c; didactic, or instructive; elegiac, or sentimental, and affecting; satirical, or censorious; epigrammatic, or witty and ludicrous; and pastoral, or descriptive of country life.

Historical, relating to history.

Lyric, pertaining to a lyre.

Didactic, doctrinal; relating to doctrines or opinions.

Elegiac, relating to elegy; mournful, sorrowful.

Elegy, a mournful song: a funeral composition; a short poem without points or affected elegance.

Satirical, severe in language; relating to satire.

Satire, a poem in which wickedness or folly is censured.

Epigrammatic, relating to epigram,—a short poem ending in a particular point or meaning, understood but not expressed.

Pastoral, from *pastor*, a shepherd; relating to rural employments and those belonging to shepherds.

What is Astronomy?

The science which treats of the heavenly bodies, their arrangement, magnitudes, distances and motions. The term Astronomy is derived from two Greek words, signifying the *law* of the *stars*; *astron* being the Greek for star.

What can you say of its origin?

Its origin has been ascribed to several persons, as well as to different nations and ages. Belus, King of Assyria; Atlas, King of Mauritania; and Uranus, King of the countries situated on the shores of the Atlantic Ocean, are all recorded as the persons to whom the world is indebted for this noble science. Its origin is generally fixed in Chaldea. Some choose, however, to attribute it to the Hebrews; others to the Egyptians,—from whom, they say, it passed to the Greeks.

What country is meant by Mauritania?

Mauritania is the name formerly given to a country in the northern part of Africa. Chaldea is the ancient name for Babylonia, now called Irak Arabi, a district of Asiatic Turkey.

By whom were the heavenly bodies first divided into Constellations or groups?

By the ancients. The phenomena of the heavens were studied in very early ages by several nations of the East. The Chaldeans, the Indians, the Chinese and the Egyptians have all left evidence of the industry and ingenuity with which their observations were conducted.

Phenomena, appearances.

Ingenuity, skilfulness.

What progress did they make in Astronomy?

They built observatories,—invented instruments for observing and measuring with correctness,—separated the stars into different groups or constellations, for the more easily finding any particular star,—gave particular names to most of the moving stars or planets, and noted the periods which each took to move through its apparent path in the heavens; and in many other ways the ancients helped to lay the foundations of that mass of astronomical knowledge which men of later ages have brought to more maturity.

Constellation, a cluster of fixed stars; an assemblage of stars.

Observatory, a place so built as to command a view of the heavens.

Who first taught the true system of the Universe?

Pythagoras, one of the most distinguished philosophers of antiquity. He is thought to have been a native of Samos, an island in the Archipelago; he flourished about 500 years before Christ, in the time of Tarquin, the last King of Rome. Pythagoras was the first among the Europeans who taught that the Earth and Planets turn round the Sun, which stands immovable in the centre;—that the diurnal motion of the Sun and Fixed Stars is not real, but apparent,—arising from the Earth's motion round its own axis, &c. After the time of Pythagoras, Astronomy sunk into neglect.

Philosopher, one who studies philosophy.

Philosophy, all knowledge, whether natural or moral. The term is derived from the Greek, *philos*, lover, and *sophia*, wisdom.

By whom was it revived?

By the family of the Ptolemies, kings of Egypt, who founded a school of astronomy at Alexandria, which produced several eminent astronomers, particularly one named Hipparchus. The Saracens, on their conquest of Egypt, became possessed of the knowledge of Astronomy, which they carried with them out of Africa into Spain; and thus, after a long exile, it was introduced afresh into Europe.

Did not Astronomy from this time make great progress?

Yes; it made considerable advances, being cultivated by the greatest geniuses, and patronized by the greatest princes. The system of the Ptolemies, called the Ptolemaic, had hitherto been used, with some slight alterations; but Copernicus, an eminent astronomer, born at Thorn, in Polish Prussia, in 1473, adopted the system which had been taught by Pythagoras in Greece, five or six hundred years before the time of

Ptolemy. About the same time with Copernicus flourished Tycho Brahe, born in Denmark, 1546.

Geniuses, men gifted with superior mental faculties.

Mental, belonging to the mind.

Faculties, powers of doing anything, whether menial or bodily; abilities; powers of the mind.

What next greatly forwarded this interesting science?

The introduction of telescopes by Galileo, who by their means discovered the small stars or satellites which attend the planet Jupiter; the various appearances of Saturn; the mountains in the Moon; the spots on the Sun; and its revolution on its axis.

Satellites, attendants.

What celebrated Astronomer arose in England?

The immortal Sir Isaac Newton, born in 1642, at Woolsthorpe, in Lincolnshire, who has, perhaps, contributed more to the advancement of this science than any one who had before existed. Dr. William Herschel, a native of Hanover, in Ger[190]many, born in 1738, likewise made many useful discoveries in Astronomy: it was he who first discovered the seventh primary planet, which he named, in honor of King George the Third, the Georgium Sidus. George the Third took him under his especial patronage, and constituted him his astronomer, with a handsome pension. He resided at Slough, near Windsor, where he died, in 1822.

Patronage, support, favor.

Constituted, appointed to any particular office or rank.

Pension, yearly allowance of money.

What other circumstance contributed to the advancement of Astronomy?

The increasing perfection of our astronomical instruments,—by means of which, the most important and interesting discoveries with regard to the heavens have been made. It is now supposed that the myriads of the heavenly bodies are all distinct worlds; it is certain, from observations made by the aid of the telescope, that the moon has its mountains, valleys, and caverns. One of the greatest astronomers of our day was the eminent Father Secci.

What are generally meant by the Arts?

Systems of rules designed to facilitate the performance of certain actions; in this sense, it stands opposed to science. The terms *art* and *science* are often incorrectly used.

Science relates to principles, and art to practice. The word art is derived from a Greek word signifying utility, profit. Arts are divided into liberal and mechanical.

What are the Liberal Arts?

The liberal arts are those that are noble and ingenious, or which are worthy of being cultivated without any immediate regard to the pecuniary profit arising from them. They are Poetry, Music, Painting, Sculpture, Architecture, Grammar, Logic, Rhetoric, Astronomy, and Navigation. The arts which relate more especially to the sight and hearing are also called Fine Arts.

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Pecuniary, relating to money.

Military, belonging to soldiers, or to arms.

What do the Fine Arts usually include?

All those which are more or less addressed to the sentiment of taste, and whose object is pleasure; these are more especially Music, Painting, Sculpture, and Poetry.

What are the Mechanical Arts?

Those in which the hand and body are more concerned than the mind, and which are chiefly cultivated for the sake of the profit attending them. To this class belong those which furnish us with the necessaries of life, and which are commonly called trades, as carpentry, weaving, printing, &c. There are also many other arts, as the art of writing, &c.

When was the art of Writing invented?

It is supposed that the art was invented before the Deluge: it was certainly practised long before the time of Moses. There were, doubtless, many steps taken in slow succession before the invention of alphabetic writing. Perhaps the earliest method might have been that which is still employed among the untutored tribes of North American Indians, who record events by picture-painting of the rudest description. Picture-painting was afterwards gradually converted into the hieroglyphical system, which is still the only kind of writing among the Chinese. It is not known who invented the alphabetic system of writing.

Deluge, a flood: the term used in particular to denote that mighty flood of water with which God swept away the first nations of the earth for their wickedness.

Alphabetic, from alphabet, the series of written signs of language called letters. The word is formed from *alpha*, *beta*, the names of the first two letters of the Greek alphabet.

Untutored, ignorant, unlearned.

Were not the Egyptians quite early acquainted with this art?

Yes, they were acquainted with two or three kinds of writing, as well as the one in which symbolical characters were employed, which was not used for common purposes. On the [192]contrary, such symbols had something of a sacred character about them, being unknown to the common people, and only to be deciphered by the priests. Obelisks and pyramids were the great national records; and on these the hieroglyphics were constantly used, because unintelligible to the people, until expounded by those who had the exclusive office of explaining them.

Symbolical, having the nature of signs or symbols—that is, representations of different things.

Deciphered, read, understood, made out.

Unintelligible, that cannot be understood.

Expounded, explained, interpreted.

Were Hieroglyphics employed before or after Alphabetic Writing?

They were undoubtedly employed at first from necessity, not from choice or refinement; and would never have been thought of, if alphabetical characters had been known. This style of writing must be reckoned as a rude improvement upon picture-writing, which had previously been used. Hieroglyphics were employed by the Egyptian priests in after times, as a kind of sacred writing, peculiar to themselves, and serving to give an air of mystery to their learning and religion, though fallen into disuse for other purposes.

What materials were employed by ancient nations in Writing?

The Eastern nations used tables of stone, brass, and wood, so that the characters were engraved instead of being written in the usual manner. The instrument used in writing on wood, was made of metal, and called a *style*. For stone, brass, &c., a chisel was employed. When the bark and leaves of trees, skins, and other materials of a more pliant nature, superseded the above-named tables, the chisel and the style, or stylus, gave way to the reed and cane, and afterwards to the quill, the *hair* pencil (as now used by the Chinese,) and the convenient lead pencil.

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Engraved, inscribed with the graver, a tool used in engraving on stone, &c.

Pliant, yielding, easily bent.

Have not the various nations among whom this useful art has been cultivated, adopted different ways of arranging their written characters?

Yes. The Hebrews, Chaldeans, Syrians, Arabians, and Egyptians, begin each line on the right side, and write towards the left. The Greeks, Latins, and all European nations, write from left to right. The natives of China, Japan, Cochin China, Corea, &c., write from the top to the bottom of the page.

Where are Cochin China, and Corea?

Cochin China is a country situated in Eastern Asia. Corea is a peninsula of Asia, subject to China.

What is meant by Science?

A clear and certain knowledge of anything founded on self-evident principles, or demonstration. The term is, however, more particularly applied to a systematic arrangement of the principles relating to any branch of knowledge, and is employed in this sense in opposition to art: thus the theoretical knowledge of chemistry is ranked as a science, but the practical part is called an art; thus it is sometimes spoken of as a science, sometimes as an art.

Practical, relating to action, not merely speculative.

What is Chemistry?

A science which enables us to discover the peculiar properties of natural bodies, either in their simple or compound state, and the elementary or first principles of which they are composed, by the processes of analysis and combination. Chemistry treats of those changes in natural bodies which are not accompanied by *sensible* motions.

Compound, mixed.

Analysis, a separation of a compound body into the several parts of which it consists.

Is not the knowledge of Chemistry very ancient?

Chemistry, as far as it regards the separating of metals from [194]foreign matters in the ore, smelting and refining them, is of the highest antiquity; it is even supposed to have been understood and practised in the antediluvian world.

Antediluvian, before the flood.

What nation appears to have excelled in Chemistry in early times?

The Egyptians were no mean proficients in many chemical operations, especially in the arts of working metals, softening ivory, vitrifying flints, and imitating precious stones.

Chemistry, however, experienced the common fate of all the arts, at the decline of the Eastern empire.

Proficients, those who have made great progress in any art or science.

By whom was it revived?

After having long lain buried, the famous Roger Bacon revived it; and from his time to the present day it has gradually progressed to a state of perfection. In former times, the art of chemistry consisted only in the knowledge of working metals, &c.; but in latter ages, its bounds have been greatly enlarged. The knowledge of Chemistry leads to many interesting and important discoveries, and the arts and manufactures are greatly indebted to its aid; indeed, it is requisite to be a good chemist, in order to attain to perfection in many of them.

Requisite, necessary.

By what other name has Chemistry been known?

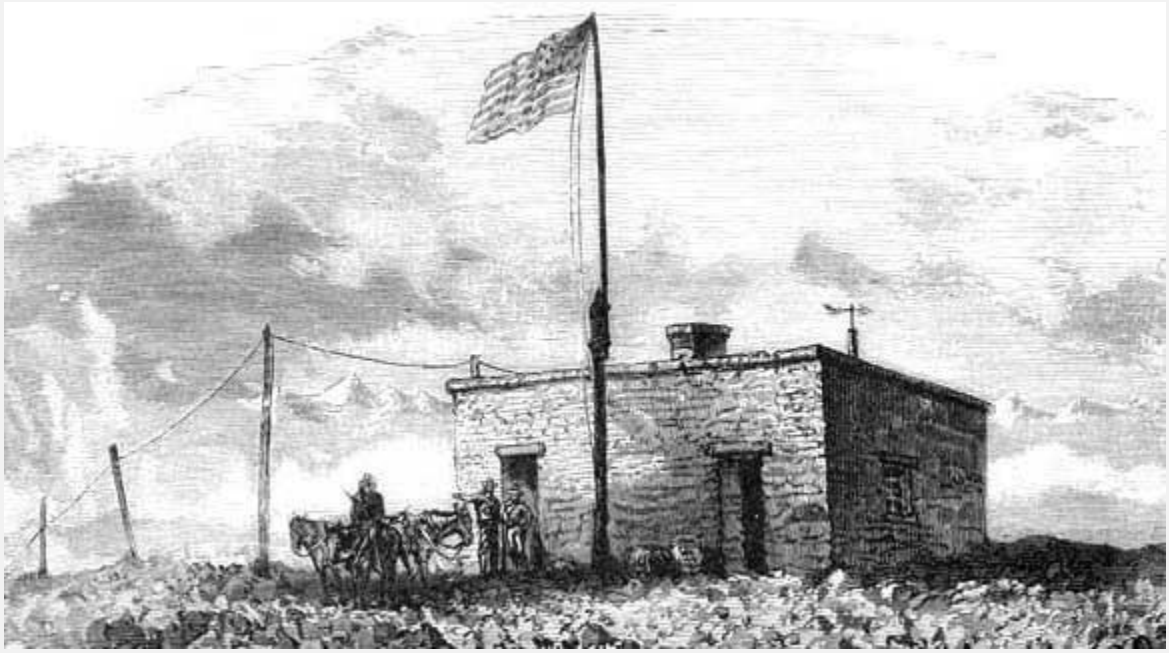
It was sometimes called *Alchemy*; by which is properly understood a refined and mysterious species of chemistry, formerly much practised.

What were its objects?

The discovery of the art of converting metals into gold, including the search after the "Philosopher's Stone," by which this change was to be effected; and the discovery of a panacea or medicine for the cure of all diseases.

What was the Philosopher's Stone?

A substance, for numbers of years eagerly sought for, which[195]was to convert metals, such as lead, copper, &c. into gold. This unknown substance was called the Philosopher's Stone, probably on account of the number of learned men who engaged in the search after it.



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Was this search successful?

No; but the delusion lasted several centuries, notwithstanding the failures, losses, and disappointments of those engaged in it. Indeed, so severe and ruinous were these, in many instances, that laws were passed to forbid the study. In Germany, many of the alchemists who had the unfortunate reputation of possessing this wonderful stone were imprisoned and furnished with apparatus till they should purchase their liberty by making an ounce of gold.

Delusion, an error arising from false views.

Apparatus, a complete set of instruments or tools, by which anything is made, or any operation performed.

Was any gold ever produced by this method?

Not a particle; the story of a stone having the property of converting the baser metals into gold being merely an absurd fable: yet, although the pursuits of Alchemy were the most preposterous that can be conceived, the ardor with which they were followed, and the amazing number of experiments made in consequence, led to the discovery of many facts to which Chemistry is highly indebted.

Preposterous, absurd, foolish; contrary to nature or reason.

You inform me that Chemistry enables us to discover the properties of bodies by means of *analysis* and *combination*: what do these terms imply?

If a chemist wishes to examine the properties of a compound body, he proceeds by analysis—that is, by a separation of the substance to be examined into its constituent parts. The chemical examination of bodies is generally effected by producing a change in the *nature* or *state* of the body under examination. This change is frequently brought about by the addition of some [196]*other* substance which forms a combination with a part of the substance examined, and leaves the remainder in a detached state.

By what *means* do Chemists effect a change in the qualities or states of natural bodies?

It is generally effected by means of *heat*, which has a tendency to separate the particles of bodies from each other; or by the *mixture* or *combination* of some other matter with the matter intended to be examined. The mixture of two or more compounds often produces a decomposition by means of chemical *affinity*, a property which different species of matter have to unite with each other; and which is sometimes called *elective affinity*. Thus it may be observed, chemists have not only the power of decomposing natural bodies, but of producing by combination various other substances, such as are not found in the kingdom of nature.

What do you mean by *decomposition*?

In chemical language, it means the separation of a compound body into its simple elements.

Give me an example.

Water may be decomposed, and reduced into oxygen and hydrogen,—both of them simple substances incapable of further decomposition.

Is not the work of decomposition perpetually going forward?

Yes; and *combustion* is one of the great agents in this work. By it animal and vegetable substances are converted into water and carbonic acid, by the union of their hydrogen and carbon with the oxygen of the air. These, in time, are again absorbed by vegetables, and again decomposed to set the oxygen at liberty to produce fresh combustions.

Of what use are the two remaining substances, Hydrogen and Carbon?

These are appropriated by the vegetative organs to their [197]growth and nourishment, while the oxygen with which the carbon was combined is abundantly given off to purify the air and render it fit for the respiration of animals.

Give me an idea of the mode in which Chemists ascertain the *affinity* of bodies, by relating an experiment.

Dissolve a tea-spoonful of sugar of lead in water, and pour the clear solution into a decanter or large glass bottle. Then take a small piece of zinc, and twist round it some brass or copper wire, so as to let the ends of the wire depend from it in any agreeable form. Suspend the zinc and wire in the solution which has been prepared; in a short time, metallic lead will deposit itself on the zinc and along the wire. This is a beautiful illustration of chemical affinity; the acid, which constitutes a part of the sugar of lead, has a stronger affinity for the zinc than for the lead, and, consequently, will combine with the zinc, and form a compound which remains in solution, while the lead is precipitated on the zinc and wire in the form of a brilliant tree of metal.

Affinity, in chemistry, that attraction which takes place between the elements of bodies, and forms compounds.

What does the word Nature signify?

In the above sense, the system of the universe; the creation, the works of God. By the kingdom of nature is meant the world and all things in it: nature is divided into three kingdoms, the animal, vegetable, and mineral.

What are the different states of natural bodies?

All bodies are either solid, liquid, or aeriform. By solid bodies are meant those whose parts unite so firmly as to resist the impression or penetration of other bodies; by liquid, those substances whose parts do not unite firmly, but have free motion among themselves; by aeriform, fluid substances, having the form or nature of air. Liquid substances are nothing more than solids converted into liquids by heat, a certain increase of which would convert the liquids into vapor.

What other name is given to Liquids?

They are likewise called fluids: we call the air, also, a fluid, because it flows like a fluid, and light substances will float in it.

What is the cause of bodies floating on liquids?

It is an established law of nature, that all substances which weigh less than an equal bulk of any liquid, will float on the surface of this liquid. Thus a cork will float on water, while a stone sinks to the bottom. The cork will not float in the air, though lighter than water; and the stone is not heavier than the *whole* of the water, but more so than a portion of water of its *own bulk*,—and thus it sinks in it. Stones also differ in their weight or gravity: for instance, some of the asbestus kind are *lighter* than water. Iron, brass, indeed, nearly all substances, except gold and platina, will float upon mercury, because they are lighter than this liquid.

What is the cause of bodies being either solid, liquid, or aeriform?

When the principle of *attraction* prevails, it causes them to become solid; when caloric prevails, they become aeriform. Fluidity is, apparently, a medium between the two.

How is the state of Solidity in bodies accounted for?

The particles of all bodies are subject to two opposite powers, *repulsion* and *attraction*; between which they remain in equilibrium. While the *attractive* force remains strongest, the body remains in a state of solidity; but if heat destroys this force, the particles lose their cohesion, and the body ceases to be solid.

Cohesion, act of sticking together, union of the constituent parts of a body.

Which is supposed to be the most natural state of all bodies?

Solidity; for by the *combination* of caloric with them we can reduce most substances to the fluid state; while the greatest number of *liquid* substances take a *solid* form by the loss of [199]caloric. Thus, water congeals and forms ice; and even the gases show this disposition to become solid, when they lose their *elasticity* by forming some *combination*.

Explain the terms *Repulsion* and *Attraction*.

Repulsion is a peculiar property in the particles of matter, which gives them a constant tendency to recede from each other. Attraction is an unknown force, which causes bodies or their particles to approach each other. The particles of all bodies possess this property, which causes them to adhere, and preserves the various substances around us from falling in pieces.

What different kinds of Attraction can you mention?

Attraction may be distinguished into that which takes place between bodies at sensible distances, and that which manifests itself between the *particles* of matter at insensible distances.

Give an example of the first kind of attraction.

One of the most familiar instances of attraction at sensible distances is seen in the descent of heavy bodies to the ground. When a stone is lifted up in the hand, the earth's attraction, which previously caused it to remain at its surface, is overcome; but, as soon as the hand is withdrawn, the stone falls to the earth. The force which causes this is called the *attraction of gravitation*, or simply *gravitation*.

How is the second kind of attraction, or that between the particles of bodies, subdivided?

Into the *attraction of aggregation*, or *cohesion*; and *chemical attraction*, or *affinity*. The former takes place between particles which are *similar*, and the latter between those which are *dis-similar*. All the operations of chemistry are founded upon the force of affinity which Nature has established between the particles of different kinds of matter, and which enables the chemist to produce *new* compounds differing more or less from the substances by whose union they were formed.

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Is it, then, necessary for chemists to understand the relative nature of all substances?

Yes; because the basis of this science consists in an *analytical* examination of the works of Nature; an investigation of the properties and uses of all substances we are acquainted with; and the study of the effects of *heat* and *mixture*, in order that we may find out their general and subordinate laws.

Analytical, relating to analysis.

Investigation, act of searching, or tracing out.

Subordinate, inferior in nature, dignity or power.

Relate a few more of the advantages obtained by a knowledge of Chemistry.

Many of the wonderful operations of Nature, and the changes which take place in substances around us, are, by its means, revealed to us. In every manufacture, art, or walk of life, the chemist possesses an advantage over his unskilled neighbor. It is necessary to the farmer and gardener, as it explains the growth of plants, the use of manures, and their proper application: and indispensable to the physician, that he may understand the animal economy, and the *effects* which certain *causes* chemically produce; and the nature of animal, vegetable, and mineral poisons. The study is, therefore, an invaluable branch in the education of youth: it is useful, not only in the active, but the *moral* life, by laying the foundation of an ardent and inquiring mind. Even an everyday walk in the fields can be productive of instruction, by a knowledge of it;—and let us always remember, that "Knowledge is Power."

Indispensable, necessary, not to be done without.

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CHAPTER XIX.

ATTRACTION, TIDES, GRAVITY, ARTESIAN WELLS, AIR, ANEROID BAROMETER, EAR-TRUMPET, STETHOSCOPE, AUDIPHONE, TELEPHONE, PHONOGRAPH, MICROPHONE, MEGAPHONE, TASIMETER, BATHOMETER, ANEMOMETER, CHRONOMETER.

What is Attraction?

By attraction is meant that property or quality in the particles of bodies which makes them tend toward each other.

Are there several kinds of attraction?

Yes. Attraction has received different names, according to the circumstances under which it acts: The force which keeps the particles of matter together to form bodies or masses, is called attraction of *cohesion*; that which makes bodies stick together only on their surfaces, is called *adhesion*; that which inclines different masses toward each other, as the earth and the heavenly bodies, is called *gravitation*; that which forces the particles of substances of different kinds to unite, is known under the name of *chemical attraction*; that which causes the needle of the compass to point constantly toward the poles of the earth, is *magnetic attraction*; that which is excited by friction in certain substances, is known as *electrical attraction.*

How do you know that attraction exists through the whole universe?

This great universal law was first discovered by Sir Isaac Newton. The sun and planets and other heavenly bodies are only guided in their path by gravitation.

Do we experience this attraction upon our earth?

Yes; because our earth is carried around the sun by it; and, further, the tides show it very clearly.

What are the Tides?

The ebbing and flowing of the sea, which regularly takes [202]place twice in twenty-four hours. The cause of the tides is the attraction of the sun, but chiefly of the moon, acting on the waters of the ocean.

What is Gravity?

Gravity is the attraction between the earth and the bodies on the earth, which makes what we call weight of bodies.

What do you understand by specific weight or gravity?

It means the weight of a body as compared with the weight of an equal bulk of some other body taken as a standard—commonly water.

Why do we say that certain metals—as, for example, platina or gold—are heavier than others, say, lead or iron?

Because the former have a greater specific gravity.

But is not a pound of gold as heavy as a pound of lead?

Yes; but a lump of gold will be heavier than a lump of lead of equal bulk.

Can we explain by this what we call floating?

A body will float in water if its gravity is less than that of water; for example, wood floats for this reason in water, and a balloon in the air.

Why does a portion of the floating body sink below the surface of the water?

Because the body in order to float must displace a portion of water equal in weight to the whole floating body.

But why do iron steamers float—iron being heavier than water?

Because the steamer is not a solid piece of iron, but is hollow, and so increased in bulk; for that reason the weight of the vessel and its contents is less than that of an equal bulk of water.

How can you ascertain that air has weight?

We can do it by the barometer and by very many experiences in daily life. If one end of a straw be dipped into a vessel of water and the other end be sucked, the liquid will [203]rise to the mouth. There we see the pressure of the outside air forces the liquid through the straw where the air was removed by sucking.

Can you show the same by another instrument?

Yes; the common water pump demonstrates the same as the straw. A tube is placed into the water, the air is sucked out from the tube by the movement of the pump, and the outside air presses the water through the tube.

What are Artesian wells?

Wells so named because they were made first at Artois, in France. They work on the principle that every liquid seeks its level. Of the rain which falls, a part soaks into the soil of mountains, until, coming to a layer of rocks or clay through which it cannot pass, it will collect and be stored up. If a hole be bored into this reservoir the water will rise in it.

Do you know some other properties of air?

It is the most necessary substance for our life; it is the vehicle of all odors and smells; it is the medium of all sounds, and brings to our ear and so to our mind an immense knowledge of the outside world; it is the cause of the beauty of the blue firmament or sky, of the aurora and twilight; it is the great nurse of the whole vegetable kingdom by clouds, rain, and dew.

What is an Aneroid Barometer?

It is a barometer in the construction of which no quicksilver or other liquid is used. It consists of a metal box, exhausted of air, the top of which is of thin metal, so elastic that it readily yields to alterations in the pressure of the atmosphere. When the pressure increases, the top is pressed inwards; when, on the contrary, it decreases, the elasticity of the lid, aided by a spring, tends to move it in the opposite direction. These motions are transmitted by delicate levers to an index which moves on a scale. This barometer has the advantage of being portable.

What is the Ear-trumpet?

A trumpet-like instrument used to aid deaf persons in hearing. Its form is conical, and the larger end is of a bell shape; the small end is placed in the ear, and the person talks in the large end. It acts by concentrating the voice on the listener's ear.

What is a Stethoscope?

An instrument used by physicians for ascertaining the action of the lungs, judging by the sound of their motion whether they are healthy or not.

Describe the Audiphone.

It is a fan-shaped instrument to help deaf people, and is made of flexible carbonized rubber. Fine silk cords attached to the upper edge bend it over, and are fastened by a wedge in a handle. The top edge of this fan rests upon the upper teeth, and the sound waves strike its surface; the vibrations are thus conveyed by the teeth and the bones of the face to the acoustic nerve in the ear.

Describe the Telephone.

It is an instrument by which conversation may be carried on at a distance, and is composed of three parts—a thin disk of soft metal, a small coil or bobbin of silk-covered copper wire, and a small bar magnet about four inches long. The bobbin is placed on one pole of the magnet, so that the wire is as it were steeped in the magnetic space round the pole. The metal disk is placed face close to the pole and bobbin, so that when it vibrates in front of the pole a series of wave currents will be set up in the coil of wire on the bobbin. The whole is encased in wood, and a mouth-piece is provided for

speaking against the disk. The coil of wire on the bobbin is of course connected by its two ends into the circuit of a telegraph line.

Who invented the Telephone?

It was invented, almost simultaneously, by Alex. Graham [205]Bell, a native of Scotland, and Professor of Vocal Physiology in the Boston University, and Elisha Gray, of Chicago.

What is a Phonograph?

It is an instrument for recording the vibrations of sounds, and consists of a revolving cylinder covered with tin-foil. To this cylinder is attached a mouth-piece, fitted with a thin plate or disk, on the outer side of which, next to the cylinder, is a needle or point. The cylinder runs on a screw, so that the whole length of it, from end to end, may pass under the point. On speaking into the mouth-piece the voice causes the disk to vibrate, and the point to trace marks corresponding to these vibrations on the tin-foil. By turning the cylinder so that the point again passes into the marks in the tin-foil, the sounds that entered at the mouth-piece can be reproduced at any time.

By whom was the phonograph invented?

By Thomas A. Edison, who was born in Ohio in 1847. Mr. Edison is the inventor of many improvements in telegraphy, which have been adopted into general use, and are to him the source of a large income. To him, also, we are indebted for the megaphone, microphone, tasimeter, an improvement in the telephone, a system of electric lighting, and many other inventions.

What is a Microphone?

This instrument is a variety of telephone by means of which faint sounds can be heard at a very great distance. It consists of a small battery for generating a weak current of electricity, a telephone for the receiving instrument, and a speaking or transmitting instrument. The last is a small rod of gas carbon with the ends set loosely in blocks of the same material. The blocks are attached to an upright support, glued into a wooden base board. This instrument is connected with the battery and the telephone. So wonderfully sensitive is it, that the ticking of a watch, the walking of a [206]fly across a board, or the brush of a camel's-hair pencil can be heard even though it be hundreds of miles distant.

Will you describe the Megaphone?

It is a substitute for the ear and speaking trumpet. It consists of three paper funnels placed side by side. The two larger ones are about 6 feet 8 inches long and 27-1/2 inches in diameter, and are each provided with a flexible tube, the ends of which are held to

the ear. The centre funnel, which is used as a speaking-trumpet, does not differ materially from an ordinary trumpet, except that it is larger and has a larger bell mouth. Two persons, each provided with a megaphone, can, without other apparatus, carry on a conversation at a distance of one and a half or two miles.

What is the Tasimeter?

It is an instrument, sensitive to the smallest degree of heat, and is mostly used in astronomy. Attached to a telescope it will show the heat coming from the stars.

What is a Bathometer?

This ingenious instrument, the invention of Prof. Siemens of London, enables those on board of ships to read from an index the depths of the ocean beneath them. It consists of a highly sensitive steel spring to which a heavy piece of metal is attached. The changes in weight to which the latter is subject in consequence of the variations of attractive force (the deeper the ocean the smaller the latter, and vice versa) are registered on a scale by the indicator that is in connection with the steel spring.

What is an Anemometer?

An instrument for measuring the velocity and force of the wind, and by which storms, at a distance, can be predicted.

What is a Chronometer?

A time-piece of delicate and exact construction, chiefly employed by astronomers and navigators. It differs only from an ordinary watch in its delicate springs, in not being so much [207]influenced by heat and cold, and consequently in its accuracy in giving the time.

CHAPTER XX.

LIGHT, LIME LIGHT, MAGNESIUM LIGHT, ELECTRIC LIGHT, RAINBOW, PRISM, SPECTRUM, COLORS, PHOTOGRAPHY, CAMERA OBSCURA, STEREOSCOPE, KALEIDOSCOPE.

Do you know something about the nature of Light?

Light is a mere form of vibration like sound, and like sound it requires some source to set this vibration going, and some medium to carry this vibration as air carries sound.

Is not the air this medium?

No, it is supposed that there is an elastic fluid called "ether" which pervades all space and matter, and if the molecules of a body are in motion they have the power of setting this ether in motion. The movement thus produced will appear either as heat or light according to its velocity.

What sources of light do you know?

We are told that the principal source of light on earth is the sun, either directly with its own beams or indirectly by supplying us with combustibles to produce light; for oil, gas, candles, and most of the substances used for producing light and heat when burning are but sending forth in another form the rays of the sun which were stored up in nature's economy.

Another source of light is the result of chemical action, such as the lime, magnesium, and electric light. A third source of light is phosphorescence, as we see it in the glow-worm and fireflies.

What is the Drummond or Lime Light?

It is one of the most brilliant of artificial lights. When a stream of oxygen and one of hydrogen under pressure are brought together and mixed within a few inches of the end [208]of a blowpipe, the mixture on lighting burns with a colorless flame possessing intense heat. If this flame be made to play upon a ball of carbonate of lime, the lime on becoming white hot gives off a powerful incandescence.

Incandescence, the glowing whiteness of a body caused by intense heat.

What is a Blowpipe?

A tube, usually bent near the end, terminated with a finely-pointed nozzle, for blowing through the flame of a lamp or gas-jet, producing thereby a small conical flame possessing intense heat. It is used in soldering silver, brass, etc. A mixture of oxygen and hydrogen when ignited constitutes the hydrogen blowpipe, invented by Dr. Hare of Philadelphia.

What is Magnesium Light?

When the metal magnesium is rolled out into a fine ribbon and heated to red heat it burns with a dazzling light.

Which is the most powerful artificial light?

The so-called Electric light. This light, whether produced by a series of galvanic cells or by dynamic power, is the most brilliant and useful.

What is a Rainbow?

The rainbow is that beautiful semi-circular band or arc of different colors in the clouds during the occurrence of rain in sunshine. When the clouds opposite the sun are very dark and rain is falling from them, the rays of the sun are divided by the raindrops as they would be by a prism. There are often two rainbows at the same time, because the primary bow is again reflected to another layer of clouds.

What is a Prism?

A triangular solid piece of glass, on which if a ray of light be cast it will be distinctly divided into the seven colors we see in a rainbow. By this fact we see that white light is composed of different rays which have different reflective susceptibilities.

What is a Spectrum?

It is this beautiful band of seven colors obtained by the refraction of a ray of light through the prism.

Whence come the colors in the objects we see in nature?

They all come from light; every object has a power to absorb certain rays and to reflect others. A red cloth, for example, absorbs all the other colored rays except red, and this it gives off, thus appearing red.

Why are the leaves of plants green?

Because a peculiar chemical substance called chlorophyl, formed within their cells, absorbs all other rays of light, reflecting only blue and yellow—which mixture produces the different green tints.

What is Photography?

The word means "light drawing." It is a mode of fixing on certain substances the lights and shades of any object by means of a lens inserted in a camera obscura. This process was first called Daguerreotype from the name of the inventor, Daguerre. A plate of copper thinly coated with silver is exposed to the vapor of iodine, then placed in a camera obscura, where an image of the object to be presented through a lens is cast upon it. Ambrotype is the same application to glass. There are now different variations of method in the use of the same agents. Now photography consists in taking the images on what is called a negative—that is, a glass coated with a silvered collodion (gun-cotton dissolved in alcohol and ether) film. From this plate another image is taken on silvered paper, which we call the positive image. There are also other chemicals used instead of silver.

What is a Camera Obscura?

A small box or dark room into which the light is admitted through a lens.

What is a Stereoscope?

It is an instrument exhibiting the effects and advantages of seeing with two eyes. The instrument is so constructed that [210]from a flat picture we may see the solid body in its reality in nature.

What is a Kaleidoscope?

An instrument invented by Sir David Brewster, consisting of a tube with slips of reflecting glass so arranged in the interior that small beads, bits of colored glass, and similar things are, by revolving the tube, thrown into an endless variety of beautiful shapes.

CHAPTER XXI.

ELECTRICITY, ELECTRIC CURRENTS, ELECTRIC BATTERY, ELECTROTYPING, STEREOTYPING, TELEGRAPH, OCEAN CABLE, LIGHTNING ROD, THE GULF STREAM, THE MT. CENIS TUNNEL, THE SUEZ CANAL, SUSPENSION BRIDGES, EMINENT AMERICANS.

What is the nature of Electricity?

A form of energy into which all other forms can readily be converted.

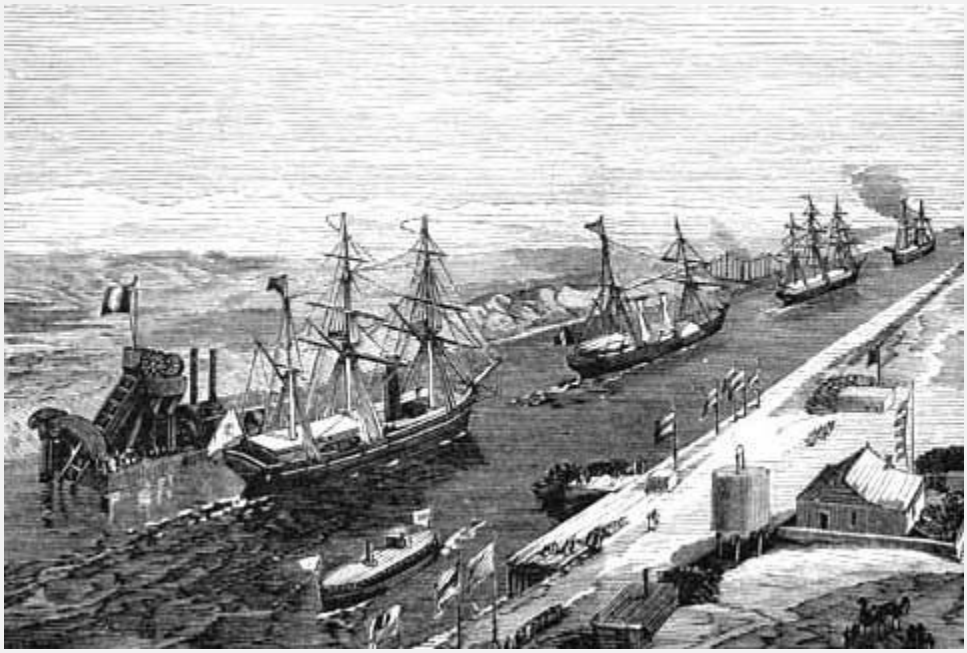
What is an Electric current?

Electricity manifests itself in a variety of ways, but all may be arranged under two heads, *viz.*, 1, as a charge; 2, as a current. By means of friction, many bodies become electrified—that is, have acquired an electrical charge. If this charge is in great quantity we call it high tension. When a body containing an electrical charge is brought in contact with other bodies through which electricity is capable of passing, there ensues a current of electricity. Such bodies are called conductors.

What are the sources of currents?

There are currents produced by chemical action called voltaic currents; by the action of heat, or thermo-electric currents; by the motion of magnets, or magneto-electric currents.

REMOVING THE EARTH FROM THE CANAL BY MEANS OF DROMEDARIES.



OPENING THE SUEZ CANAL—PROCESSION OF SHIPS.

What is positive and what negative electricity?

No difference in electricity in itself. When a body has more than its natural amount of electricity, it is said to be charged positively; when it has less than its natural amount it is negatively charged.

What is a Cell; what a Battery?

If a piece of zinc and copper joined by a wire be dipped in a liquid—generally weak sulphuric acid—which will act chemically on the metals, a current is produced. Such an arrangement is called a couple, or cell. If many cells are connected, then it is called a battery.

What is Thermo-electricity?

If two bars of any unlike metal—for example, antimony and bismuth—be soldered together at one end, and the other ends be connected by a wire and then the soldered end heated, a current will flow.

What effects are produced by currents?

They produce heat, light, decomposition and combination in liquid chemical compounds; they melt all metals, excite magnetism, and in the animal body excite movements of the muscles.

Can you specify these effects?

A strong battery produces heat in such a degree that all metals can be melted. Light is produced in flashes, or if the end of the leading wires are connected with two pencils of hard carbon, and brought very near together, then a brilliant light, or arc, called the voltaic arc, is produced. This is the dazzling bright light which we call electric light. The chemical effect of a current in decomposing compound substances is called electrolysis. In this way water can be decomposed into its compounds, hydrogen and oxygen; copper sulphate into sulphur and metallic copper, etc. In this way we can deposit strong adherent films of metal on the surface of any conductor; for if the article to be coated be attached to the negative electrode of a battery, and dipped into a solution of [212]the metal with which we desire to coat the article, say copper or silver, and the positive electrode be attached to a plate of copper and also dipped into a liquid, when the current passes, the metal will be decomposed and deposited in a uniform layer over the article at the negative electrode. This process is called *electro-plating*.

What is Electrotyping?

It is the process of copying medals, type, wood-cuts, engraved copper and steel plates, etc., by means of electrical deposition. It is chiefly used for making, from the ordinary movable types, plates of fixed metallic types, for printing books.

Describe the process.

The article to be copied is first covered with black-lead, and then a mould is made of it in wax or gutta-percha. This mould is placed in a solution of sulphate of copper, and attached to the negative pole of the battery, while a plate of copper is hung from the positive pole. The electric current decomposes the copper, which is deposited in a thin film upon the mould. This film is removed and stiffened by being backed with metal.

What is the difference between Electrotyping and Stereotyping?

In stereotyping, a plaster of Paris mould is taken from the types, and upon this mould melted type-metal is poured, which, when hardened, makes a solid plate.

Is there any other method of stereotyping?

Yes; that known as the paper process. A uniform sheet of soft matter is formed by pasting together sheets of thin, tough tissue paper. The types are oiled, and the soft, moist sheet is placed on them and beaten down with a stiff brush until it receives an impression of the type-form. Both are then run through a press, and on being taken out the paper is found to form a perfect mould. Into this mould the type-metal is poured and the plate formed.

Can you tell me some magnetic effects of the current?

All conductors become magnetic during the passage of a current through them, and thereby acquire all the properties of a magnet. There are bodies which are natural magnets, and they are called permanent magnets. Those which become magnets only during the passage of a current are called electro-magnets.

Do you know any application of those magnets?

They are employed in a great variety of electrical apparatus, principally in telegraphy.

When was the first telegraph established?

It was made in 1836, being invented by Prof. Steinheil, of Munich, and adopted by the government of Bavaria. It was 12 miles long, and the signals were made by small bells.

Who was the inventor of the telegraph in this country?

Samuel F.B. Morse, who was born at Charlestown, Mass., April 27, 1791. He began life as a painter, but did not give his whole attention to art—chemistry and experiments in electricity and galvanism claiming much of his time. He first conceived the idea of the telegraph in 1832, and exhibited his invention to Congress in 1837. He struggled on with scanty means, and was about to give up in despair when Congress appropriated

$30,000 for an experimental line, which was opened on May 12, 1844, between Washington and Baltimore. Prof. Morse died in 1872, but not before he had reaped honors and fortune from his invention.

How rapidly does the electric current travel through the wires?

From experiments made it appears to be about 15,400 miles in a second.

Can more than one message be sent at the same time on the same wire?

Yes; it is possible now to send several messages at the same time.

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What is a Cable?

It is a telegraph wire under water. Prof. Morse, in 1842, laid a wire insulated by a covering of hemp coated with pitch-tar and India-rubber between Governor's Island and the Battery, New York. Several attempts were made in other countries.

What was the greatest telegraphic undertaking?

That of connecting Europe with America by a submarine cable spanning the ocean, which was commenced in 1857 and completed August 5, 1858.

To whom do we owe this grand undertaking?

This honor is entirely due to Mr. Cyrus W. Field. Mr. Field was born at Stockbridge, Mass., on November 30th, 1819. In 1853 he became interested in ocean telegraphy, and after many reverses succeeded in laying the first cable in August, 1858. The message sent by Queen Victoria to the President of the United States, consisting of 99 words, occupied 67 minutes in transmitting. In September of the same year this cable ceased to work, but the energy of Field restored confidence, and another cable was made and laid down in July, 1865, but after 1200 miles were deposited it was lost. In 1866 another was made and successfully laid in July. In August the lost cable was found and spliced, and carried to the western shore.

What is a Dynamo-electric machine?

A machine by which very powerful currents can be obtained directly from mechanical power. In these, by means of a steam-engine or other power, a number of coils of wire called the armature are set into rapid revolution between the poles of powerful electro-magnets. All currents are caused to flow from the armature in one direction by means of a contrivance called the commutator. Very successful machines of this sort are the Gramme machine, the Siemens, and, principally, the so-called Brush machine. By these the electric light is now generally produced.

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What is a Lightning Rod?

It is a rod of iron placed against a building to protect it from lightning. Three or four feet of one end is in the moist ground or in water, while several feet of the other end extend above the highest part of the building. The upper end of the rod is pointed with copper or some other metal which will not easily corrode.

By whom was it invented?

By Benjamin Franklin, and first announced by him in his "Poor Richard's Almanac" for 1753. Franklin was born at Boston, Mass., in 1706. By his talents, prudence, and honesty he rose from humble beginnings to be one of the foremost men of his time. He was one of the committee of five chosen by Congress to prepare the "Declaration of Independence" which he with other patriots afterwards signed. Towards the close of the year 1776 he was sent as ambassador to the French Court, and remained in Europe some time. He returned home in 1785, and died at Philadelphia on the 17th of April, 1790.

What is the Gulf Stream?

It is a warm current in the Atlantic Ocean.

What is its origin?

It may be considered as beginning on the west coast of Africa, within the region of the trade winds. These cause a westward flow, known as the equatorial current. On reaching the coast of Brazil, the greater portion of this current bends northward, carrying with it the waters of the Amazon and Orinoco, and passes through the Caribbean Sea into the Gulf of Mexico. Here it is further heated, and rushes out through the only outlet, the Straits of Florida.

Describe its course.

Deep and narrow, it runs by Florida with a velocity varying from two to five miles an hour, and pressed by the cold current between it and the shore, flows parallel to the coast [216]as far as Cape Hatteras. Meeting shoals near this point, the banks of sand extending as far as Newfoundland, it there turns abruptly to the east, and with diminished speed and increased width, rolls onward towards the coast of Europe. Before long it divides into two great branches—the northern and southern. The former extends as far as Spitzbergen; the latter, sweeping along by the Madeira and Canary Islands, returns to the equator, completing the circuit.

What influence has the Gulf Stream on the climate of Europe?

Various opinions have been expressed as to this. It has been estimated that the amount of heat arising from the stream on a winter's day, is sufficient to raise the atmosphere over the British Isles from the freezing point to a summer temperature.

How may the Gulf Stream be distinguished?

It can be distinctly traced in the ocean by its dark indigo color, its temperature, and the swiftness of its waters.

Which is the largest tunnel in the world?

The Mt. Cenis Tunnel, or the tunnel of Col de Frejus, by both of which names it is known. It is the longest subterranean route for commerce and travel yet constructed, being 7-1/4 miles in length. It is on the crest of the Cottian Alps, about 16 miles south-west of the summit of Mt. Cenis Pass. It was begun in 1857, and finished in 1871.

Col, a defile.

What other great engineering work can you mention?

The Suez Canal, a ship canal running across the Isthmus of Suez, and connecting the Mediterranean with the Red Sea. The canal is 100 miles in length, and through it an uninterrupted communication is established whereby large sailing vessels and steamers may pass from sea to sea, and thus [217]avoid the long and dangerous voyage around the Cape of Good Hope.

To whom is the world indebted for this canal?

This great work owes its inception and completion to the enterprise and indomitable energy of Ferdinand de Lesseps, who was born at Versailles, France, on the 19th November, 1805. In January, 1856, he obtained a charter from the Egyptian Government for a company to construct the canal, and began work in 1859. Though beset by many difficulties, the persistent energy of De Lesseps fought its way to success, and in 1869 he had the satisfaction of seeing the waters of the Mediterranean and the Red Sea mingle in the Bitter Lakes. He has since been engaged in many engineering projects, the latest being a canal across the Isthmus of Panama to connect the Atlantic and Pacific oceans.

Inception, beginning.

Indomitable, not to be subdued.

Persistent, inclined to hold firm.

What is a Suspension Bridge?

A bridge supported by wires, ropes, or chains, which usually pass over high piers or columns at each end, and are secured in the ground below.

Name some of the largest bridges of this kind.

That at Niagara, those over the Allegheny at Pittsburg and the Ohio at Cincinnati, and the great East River bridge, which connects New York and Brooklyn.

Who planned these bridges?

John A. Roebling, who was born at Mulhausen, Prussia, June 12, 1806. In 1831 he emigrated to this country, and to his genius we are indebted for the bridges above named. The reports, plans, and specifications of the East River bridge were completed, and the work begun, when Roebling was severely injured in the foot while directing his work. Lockjaw succeeding amputation, he died in Brooklyn, July 22, 1869.

To what great Civil Engineer has the West given birth?

James B. Eads. Born at Lawrenceburg, Indiana, May 28, 1820, he began life as a clerk on a Mississippi river steam-boat. In 1842 he entered a firm engaged in recovering sunken property, and with such success that he retired with a fortune in 1857. During the civil war he devised a plan for the defence of the Western waters, and constructed several iron gun-boats with many novel features of his own invention. He has since acquired reputation as projecting and constructing engineer of the Illinois and St. Louis bridge, and by building jetties at the South Pass of the Mississippi, by which the depth of the river is increased, and it is made more navigable. These jetties are projecting dikes of brush, fascines, and stone.

Fascines, bundles of rods or of small sticks of wood, bound at both ends and at intermediate points, used in filling ditches, etc.

Give the names of some distinguished American inventors.

Eli Whitney, the inventor of the Cotton Gin, born in Westborough, Mass., 1765; died 1825. Jethro Wood, the inventor of the modern cast-iron plow, born at White Creek, N.Y., 1774; died 1834. Cyrus H. McCormick, inventor of the mowing machine, born at Walnut Grove, Virginia, in 1809.

Who was the inventor of the Sewing Machine?

Elias Howe. He was born at Spencer, Mass., July 9, 1819. When a boy he worked in a cotton mill at Lowell, but afterwards entered a machine shop in Boston. Here he conceived the idea of the sewing machine, and after long days of labor, part of which time he and his family lived on the kindness of a friend, he completed his invention. After many struggles, his talent, industry, and perseverance were rewarded, and long before his death, which occurred in October, 1867, he had acquired a large fortune.

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THE END.

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