Archimedes.

(Continued from our last.)

Archimedes appears, also to have had considerable skill in the science of optics. By a particular combination of mirrors, he is reported by historians to have burned either the whole, or part of the Roman fleet, during the siege of Syracuse. This achievement has been questioned by many modern philosophers, but whether it was actually performed or not, its practicability, at least, has been fully demonstrated by Buffon; and unless he had accomplished some such feat as this, it can scarcely be conceived how the report of it could have been so generally credited, particularly at a time when the world were strangers to the wonders of burning instruments.

Although the discoveries of Archimedes in mechanics were both splendid and triumphant yet, even they were eclipsed by those he made in the regions of pure science. And while Euclid had laid the foundation of geometry in his immaculate Elements, Archimedes raised the noble superstructure to a very high elevation, by the discovery of a series of propositions that constitute the most brilliant acquisitions of the ancients. In his Treatise on the properties of the cylinder and the sphere, he demonstrated this most beautiful theorem: That the superficial area, as well as the solid contents of every sphere, is equal to two thirds of that of its circumscribed cylinder. So justly enamoured was he of this admirable property of these solids, that he requested, that after his death, the figure of the cylinder, with its inscribed sphere, might be engraven on his tomb. And Cicero, during his quæstorship in Sicily, with that noble feeling of regard which true genius always inspires, and teaches to be due to merit though of a different kind, ordered the tomb-stone of the philosopher to be sought out, and cleared from the rubbish that concealed it from the eyes of the world.

Archimedes was the first who approximated to the rectification and quadrature of the circle, a problem which has exercised the ingenuity of mathematicians in all ages, and one which seems destined, from the nature of the inquiry, never to be perfectly accomplished. In his book on the Measure of the Circle he demonstrates the following theorem, which is of the greatest practical utility: That the area of a circle is equal to that of a triangle whose base is equal to the circumference, perpendicular equal to the radius. He also proved, That if the diameter of a circle be reckoned unity, the circumference will be between 3 10·70 and 3 10·71. The method by which Archimedes arrived at this conclusion, is one of the finest specimens of human ingenuity and is capable of carrying the approximation to the exact circumference to any degree of accuracy required. This method, which is denominated the Method of Exhaustions, contains in it the germ of all the modern discoveries, and was capable of being applied to the investigation of problems, for which even the genius of Newton found it necessary to invent a new Calculi.

In his work on Conoids and Spheroids, he has unfolded many profound and ingenious properties of these solids, and their relations to cylinders and cones of the same altitude.—He was the first that ever found the complete quadrature of a curve, by demonstrating, That the area of the parabola, bounded by a chord is two-thirds of the circumscribing parallelogram. The properties of the solids formed by the revolution of the conic sections which he discovered, are equally striking and beautiful, and such as entitled him, when we consider his other discoveries, to the appellation of the Father of Mensuration.

In his Arenarius, or Treatise on the number of the Sands, he attempted to show the possibility of expressing by numbers the grains of sand that would fill the whole space of the universe. In this work, he pointed out a property of a geometrical progression that was afterwards made the foundation of the theory of logarithms; so near was this great man to one of the finest inventions of modern times. Had the mode of notation employed by the Greeks, though vastly superior to that of any other ancient nation, been less cumbrous than it was, there can be no doubt but Archimedes would have anticipated many discoveries of the moderns. Indeed it is wonderful that he did not attempt to simplify that notation; but the tide of his ideas had already flowed beyond it, and, in the long series of ages that succeeded, no genius less lofty was found, to supply the deficiency, till the touch of science again illumed the world. In fine, the writings of Archimedes constitute some of the most precious relics of antiquity, and show that, though the progress of discovery is in general slow, there are some who can pass the point where men of ordinary capacities are at a stand, and, by the vigor of their minds, anticipate the labor of ages.

(To be continued.)

Heat by Friction.

One class of philosophers say that "the sensation of heat is produced by a certain imponderable form of matter," and another class contend that heat consists "in the motion among the particles of bodies," communicated an apparent vacuum by the waving of a subtile elastic medium, *which is* also concerned in the phenomena of light.

The production of heat by mechanical means, appears to be considered as furnishing the strongest argument against the materiality of heat. Therefore, to show how the mechanical production of heat can be explained consistently with the theory that heat is material, is to add considerably to the strength of that theory. The material theory is well supported by the phenomenon of expansion, fusion, vaporisation, conduction, condensation, radiation, reflection, and refraction; but the production of heat by friction and percussion, is thought to be best explained by the theory that heat is motion.

We must first suppose caloric to be repulsive of itself, but that it is attracted by matter.

The heat evolved by the condensation or compression of matter, is readily explained by the material theory; for supposing 10 cubic feet of any substance to contain 5,000 atoms of caloric, we have in this case 500 atoms of caloric to each cubic foot of matter; but if the substance be subjected to a force which shall compress it to one-half of its former bulk, we shall then have 1000 atoms of caloric, instead of 500, to each cubic foot of matter, and accordingly a considerable increase of sensible heat. Now, friction and percussion can be explained in just the same manner. Friction is a compound of compression and motion.

Berthollet, by subjecting metals to the stroke of a coining-press, found that the degree of heat produced by percussion is always in proportion to the degree of condensation. The first stroke was more effectual than the second, and the second than the third, both with regard to heat and condensation.

Count Rumford's experiments on frictional heat in the boring of cannon, are considered to raise considerable objections against the theory of caloric. In a half an hour, by the mere process of boring, he raised the temperature of a cannon from 60° to 130°. The borer was pressed against the cannon, on an area of two square inches with a force of 10,000 lbs. avoirdupois. The apparatus was wrapped in flannel and worked by horses; and the borer made 960 turns in the half hour. This philosopher likewise bored a cylinder of brass, insulated in water. The borer was made to revolve by machinery, 32 times in a minute. At first the temperature was 60°, but after an hour's boring it was 107°; and in 2½ hours the water boiled. The whole apparatus, weighing 15 lbs., was raised to the same temperature.

These experiments are considered to prove that heat may be obtained without limitation, by the friction of insulated metals; and it is argued, that what can be obtained from insulated bodies without limitation, cannot be material. But one great source of heat is overlooked in this reasoning, viz. the condensation of the metallic borings. It is unreasonable to suppose that a pressure of 10,000 lbs. could be exerted upon two square inches without producing some degree of compression. This compression causes an increase of heat in the condensed part, and the caloric thus rendered active is rapidly diffused through the cylinder, while at the same time the part compressed is cut away by the borer; so that the borings are condensed pieces of metal which have had some of their caloric squeezed out of them into the cylinder, which is thereby rendered hotter. Doubtless, if the bulk of the particles abraided were to be found, by immersing them in water, it would be found that they occupied less space than when they formed part of the solid cylinder. Some persons may be disposed to doubt, whether cold iron can contain sufficient caloric to raise its temperature so high; but let us consider, that matter attracts caloric, and iron is a very dense body, and accordingly must attract and retain caloric with considerable power; and this is the reason why it appears cold, when it really contains a great deal of heat. According to Dr. Black, this power of retaining strongly a certain portion of latent heat, gives the metals their ductibility. Moreover, as a great increase of heat in metals is requisite to produce a slight expansion, it might be expected that a slight degree of compression should cause a great revolution of heat.

From this consideration of the subject, it appears of very little consequence whether the metals undergoing friction are insulated or not, seeing that the heat can be produced directly from the bodies themselves.

Sir H. Davy, by making two pieces of ice rub against each other in vacuo, produced enough heat to melt them. This case is analagous to the boring of cannon. Certain particles of ice are compressed and abraided, and their caloric squeezed out and rendered active by the condensation. The analogy is still further supported by the superior density of the watery particles compared with the icy ones. Similar reasoning will apply to Boyle's experiment of producing heat by the friction of brass in vacuo.

Boring wood with a gimlet is also analagous to the boring of cannon; only in the former case, the metal having a stronger attraction for caloric than the wood has, it receives the greater part of the heat, and the gimlet soon becomes hot. This is the case in the school-boy's experiment of rubbing a button on a plank; caloric is squeezed out of the wood by the compression of its parts, and the button receives most of the caloric, owing to its strong attraction for it. It is easier to produce heat from the friction of rough surfaces than smooth ones, because in the former case certain particles are rubbed off, which being small, are readily condensed, and made to evolve their latent caloric.

Fulminating compounds are substances capable of igniting with a small degree of heat. When undergoing compression or percussion, their bulk is reduced, and their caloric concentrated in a degree sufficient to cause their ignition. When a chemical match is drawn over sand-paper, certain phosphoric particles are rubbed off, and being compressed between the match and the paper, their heat is raised sufficiently high to ignite them, and fire the match. If the match be drawn over a smooth surface, the compression must be increased, for the temperature of the whole phosphoric mass must be raised in order to cause ignition.

Dr. Young, in arguing against the material hypothesis, says that "if the repulsive particles of caloric followed each other at a distance they would still approach near enough to each other in the focus of a burning glass, to have their motions deflected from a rectilinear direction." Perhaps this is the case, for we cannot see heat but it is actually found in the prismatic spectrum, that the heating rays extend beyond and outside the illuminating rays.

Casting Bells.

Large bells are usually cast in loam moulds, being swept up, by means of wooden or metal patterns, whose contour is an exact representation of the inner and outer surfaces of the intended bell. Sometimes, indeed, the whole exterior of the bell is moulded in wax, which serves as a model to form the impression in the sand, the wax being melted out, previous to pouring in the metal. This plan is rarely pursued, and is only feasible when the casting is small. The inscriptions, ornamental scrolls, &c. usually found on bells, are put on the clay mould separately, being moulded in wax or clay, and stuck on while soft. The same plan is also pursued with regard to the ears, or supporting lugs, by which the bell is hung.

Islands of Maine.

The Hon. H. Hamblin in a recent lecture before the Mechanics' Association, in Bangor, Me., stated that in no part of the world were there, in the same distance, so many beautiful Islands as there are on the coast of Maine. He did not know how many there were. Mr. Williamson, in his history, states that there were about 400, but in fact there were about 1000 islands and islets; the larger portion of them within a space of 130 miles east of Cape Elizabeth. In the eastern part of the State, between Machias Bay and Quoddy Head, there were but very few islands. The coast in that part of the State was bold and the water in violent southeast storms, frequently dashed against it with sufficient power to be thrown into the air 100 feet.

The climate of the islands is much milder than upon the main, the winters being at least two months shorter. It has been ascertained that the range of the thermometer was from twenty to thirty degrees less upon the islands than in the same parallel of latitude upon the main land.

The islands are all noted for their salubrity, and upon some of them it is said, that when people grow very old, they were obliged to move on to the main land, in order to die.

The people upon the islands are very hospitable and generous-hearted. There are, in fact, but few, if any poor people upon our islands, and they never suffer from hunger, because they can, at any time, resort to the clam bank and fishing-ground.

The Orphan's Gratitude.

Hon. A. H. Stephens, of Georgia, in a recent address at a meeting in Alexandria, for the benefit of the Orphan Asylum and Free School, of that city, related the following anecdote:

"A poor little boy in a cold night in June, with no home or roof to shelter his head, no paternal or maternal guardian or guide to protect or direct him on his way, reached at nightfall the house of a rich planter, who took him in, fed, lodged and sent him on his way, with his blessing. Those kind attentions cheered his heart and inspired him with fresh courage to battle with the obstacles of life. Years rolled round: Providence led him on, he had reached the legal profession: his host had died; the cormorants that prey on the substance of man had formed a conspiracy to get from the widow her estates. She sent for the nearest counsel to commit her cause to him, and that counsel proved to be the orphan boy years before welcomed and entertained by her deceased husband. The stimulus of a warm and tenacious gratitude was now added to the ordinary motive connected with the profession. He undertook her cause with a will not easy to be resisted, he gained it; the widow's estates were secured to her in perpetuity; and Mr. Stephen's added, with an emphasis of emotion that sent its electric thrill throughout the house, "that orphan boy stands before you!"

Anecdote of Allston.

Some years after Allston had acquired a considerable reputation as a painter, a friend showed him a miniature, and begged he would give his sincere opinion upon its merits, as the young man who drew it had some thoughts of becoming a painter by profession. Allston after much pressing, and declining to give an opinion, candidly told the gentleman he feared the lad would never do anything as a painter, and advised his following some more congenial pursuit. His friend then convinced him that the work had been done by Allston himself for this very gentleman, when Allston was very young!

Jewish Customs.

Among the inquiries addressed to Major Noah, we find the following together with his answer:

"Was it ever the practice of the Jewish law to make malefactors drunk before execution? No. But they gave the condemned a cup of wine, in which there was frankincense to render him insensible to pain; and the compassionate ladies of Jerusalem provided this draught at their own expense. The custom is founded on the Proverbs of Solomon, chap. 13, 6th verse: "Give strong drink to him that is ready to perish and wine to those that be of heavy heart."