OUR HERITAGE OF THE MECHANICAL ARTS.

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The most important event in the history of the mechanical arts, the discovery of iron, is without a certain date. Iron is mentioned in the Vedas, the Upanishads, the Bible, and the Iliad; it appears in the fragments of Sanchoniathon; it is delineated upon the Egyptian monuments assigned to Thothmes III.; nevertheless, the date of its discovery is a problem which is not yet satisfactorily solved. The secret of smelting iron ores and converting them into metal was certainly discovered by somebody, somewhere, and at some remote time; but we know not where, when, nor by whom. When this discovery did occur, at all events when it became publicly known and commonly put into practice, it must have exercised as profound an influence upon the ancient world, as that of gunpowder and firearms has had upon the modern. Iron not only armed the people who discovered it with superior offensive weapons; it enabled them to build ramparts of stone, to pierce the rocks for silver, copper, and lead, and to fabricate nearly all those implements, tools, and devices which distinguish the mechanical arts. The name *chalybo*, for iron, points to Chalybia, and of *damas*, for steel, to Damas, or as we write it, Damascus. In the vicinity of both of these districts, very ancient iron mines have been discovered; and in the former district, at Ayazinn, Mr. Ramsay found rock sepulchers, guarded by gigantic carved lions, and a large chapel, all carved out of the solid rock, which could only have been executed with steel tools. Col. Leake found at Nacolaeia, in the Sangarius valley, a royal tomb, in the form of a temple, carved in the solid rock, with a Phrygian inscription by Attes, dedicated to Midas; while, near by, were the remains of a city, which, from its great extent, is supposed to have been the capital of the Sangarians, or Maryandians.

In the age assigned to the Judges of Israel, about the twelfth century B. C., Jabin, the King of Canaan, or Phœnicia, who dwelt at Hazor, about sixty miles southwest of Damascus, is said to have possessed nine hundred chariots of iron. (Judges iv, 3.) "Can one break iron from the North?" (Jer. xv, 12) and "I will break the bar of Damascus" (Amos i, 5) are passages which were probably written several centuries before our era, and may refer to a still more remote period; while they evidently point to the vicinity of Damascus as a well-known iron center.

Could we accept these indications for a certain guide, the advent of iron, at least so far as the western world is concerned, might be fixed at about the twelfth century before our era. Both iron and steel were certainly very scarce in the West at the periods mentioned. Homer, tenth century, mentions poleaxes, shipwrights' tools, plowshares, sheep-hooks, and chariot-wheels in the Troad; yet in Lacedæmonia, in the time of Lycurgus, ninth century, iron was still so valuable that he employed it as a material for money. The theory has been advanced that the Chalybes, Veneti, and Dorians were the same people, who, after being driven out of Asia, invaded Greece, and with their iron weapons destroyed that splendid bronze civilization which is revealed in the magnificent remains of Tiryns and Mycenæ—a theory that the pedimented hexastyle temple, carved in the Sargon relief at Monasier, goes somewhat to substantiate. Twenty-six centuries later, Cortes performed a similar exploit in Mexico. There is admittedly a gap of three centuries both in the literature and archæology of Greece, a gap that extends from the assumed date of the Dorian invasion, 1104 B. C., to the Lycurgan age. Whatever may have been the history of iron and steel during this interval, these metals only came into general use during the Solonic era, when, by their agency in opening the silver mines of Laurium, they threw upon the world those treasures which extended and quickened commerce, established the mechanical arts, and offered such rewards to discovery and invention, as will ever render that age memorable. A bare list of the illustrious men who adorned it is sufficient to suggest the most notable discoveries known to man.

The mechanical inventions which came more or less into general use during the Solonic age embrace the iron or steel hammer, saw, adz, auger, shovel, pick, chisel, gimlet, square, flint-and-steel, lock, key, and lathe; for although these and many more inventions were assigned by Pliny and others to mythological personages of a remoter age, no remains have been found of these tools, or of their products, of a period earlier than about the eighth century; this being also the age of similar implements found by Layard at Nineveh. The Vedas frequently mention iron or steel weapons, armor and tools, including the razor; but Romesh Chunder Dutt, the native historian of India, assures us that no stone statues, or other works made by iron or steel tools, have been found in India of an age much before the Buddhic era. Mr. Grote, the historian of Greece, comes to much the same conclusion with regard to that country; there are no works which involved the use of iron or steel, or even of bronze implements, much before the Solonic age. Schliemann's discoveries point to somewhat the same result. Most of the utensils, axes, hammers, knives, and saws found at Hissarlik (Troy) were of stone, but few of bronze, and none of iron. At Mycenæ, the arrows were flint-headed; the shields were made of wood, with leather attachments; while the swords, knives, tools, and utensils were of bronze. Even these were of the Iron age. The final determination of the inquiry is that while perhaps the fabrication of iron was known to the Brahmins so early as the fifteenth century, it was kept secret in the temples until the period assigned to the Mahabharata war, when it escaped to Chalybia, and there gave rise to that notable industry whose marks still excite the curiosity of the archæologist.

From Chalybia the iron industry was extended or removed to the vicinity of Damascus, whence, by the agency of Phœnician commerce, it was carried to Argos in Greece and Tarshish in Spain. (Ezek. xxvii, 12.) As the voyages of the Phœnicians to Cassiterides, for tin, could hardly have been made, except in ships whose planks were fastened together with iron spikes, or rivets, or with copper ones; and as copper, except in very small quantities, could not have been obtained without the use of iron tools to cut the inclosing rocks, it follows that, owing to the scarcity of iron down to the Lycurgan age, the earlier commerce in tin, if made to Britain, was conducted, like the amber trade, overland. Baron von Humboldt has, however, pointed out that *cashthira* is merely the Sanskrit word for tin; so that the stream-tin, which the earlier Phœnicians got from "Cassiterides," the Land of Tin, may have come from Malacca in India, or Galicia in Spain; and that the Phœnicians did not trade by sea to Britain until a later age. As for the theory that there was a Bronze age before there was an Iron one, and that during such period copper tools were hardened by an application of tin, so as to cut quartz or porphyry, the burden of proof still rests upon its advocates. Thus far, archæology does not support them.

Among the elements of material progress which marked the Solonic age was the Public Library which Aulus Gellius (vi, 18) informs us was established at Athens by Pisistratus. At subsequent periods, Ptolemy Philadelphus at Alexandria, and Eumenes II. at Pergamus, formed extensive collections of books and parchments, but solely for their own benefit, and not for that of the public. After Pisistratus, the next public library was that of Asinius Pollio in Rome.

(*To be continued.*)

NOVELTIES IN FIRE ALARMS.

Two different types of automatic fire alarms have been devised by Scotch and Danish inventors respectively. The former contrivance, in addition to raising the alarm, becomes an automatic sprinkler of considerable power as well, and thus becomes a valuable first-aid appliance, while the action of the latter is solely confined to the ringing of the alarm bell.

Some severe tests of a practical nature were recently carried out with the former device upon some extensive sawmills containing a large number of valuable woodworking machines in Aberdeen (Scotland). In this expansion system there is neither water nor compressed air in the sprinkler pipes, so that in the event of a sprinkler head becoming accidentally damaged, no flooding of the premises or other injury results. In the first test a mass of shavings and other combustibles were piled in a heap and saturated with oil and then ignited. Within ten seconds the sprinklers were pouring a volume of water upon the flames from three sprinkler heads, and the fire was rapidly extinguished.

In the second test the loading court of the mills, 65 feet in length by 25 feet wide and 3 feet high on either side, was selected. A pile of shavings similarly treated were fired here, and fanned by the severe draft blowing through the passage, was soon an immense sheet of flame. The sprinklers, however, acted, and in a few minutes the fire was completely extinguished.

For the third test, however, the machine room itself was selected to display the confidence of the inventors in their device. The mass of shavings was piled upon the floor among the seventy machines in the shop and fired. Within thirty seconds the detector acted, and streams of water poured upon the burning mass from three sprinklers, and the fire was quickly quelled—long before the arrival of the local fire brigade from the station one and one-quarter miles away, which was called by the detector. The success of this latter experiment conclusively demonstrated that the apparatus, if not successful in extinguishing a fire, is at any rate of sufficient power and value to localize it and prevent its spreading by soddening all the surroundings. The advantage of the system lies in the fact that it not only automatically calles the brigade, but renders valuable service during the initial stages of the conflagration.

In the Danish invention the alarm, which is of a very sensitive description, is only brought into action by a sudden wave of heat. The appliance consists of a U-shaped tube four inches in height filled with mercury, the upper parts containing sulphuric ether and both ends being closed. One side of the tube is covered with non-conducting material. An even and gradual rise in the temperature simply warms the whole apparatus, but directly a wave of heat such as is caused by a fire comes into contact with it, the ether under the exposed glass is vaporized, forces down the mercury, closes a local electric circuit, and thereby rings the alarm bell.

SCIENCE NOTES.

Course of Solidification of the Moon.—M. Loewy, director of the Paris Observatory, and M. Puiseux, in a communication to the Académie des Sciences, hold that the solidification of the moon extends from the surface to the center, and not, as the English scientists think, from the center to the periphery. This view would modify various existing theories. Their conclusion is drawn from the examination of photographs executed at the observatory for reproduction in the new Lunar Atlas.

The Saharan Sea of the Cretaceous Period.—M. De Lapparent announces in a communication to the Académie des Sciences that he has received fossils lately discovered by two French officers, Capt. Théveniaud and Lieut. Desplagnes, a little to the north of Timbuctoo. A calcareous block containing fossils of the Cretaceous has also been found 350 kilometers from Timbuctoo. Therefore the sea which bathed the region of Bilma on the east extended more than 300 kilometers to the north of Timbuctoo.

A gramophone which, it is said, can be heard at a distance of three miles is the latest invention of the Hon. C. A. Parsons, of turbine fame. The instrument is named the auxetophone, and is worked by means of compressed air. This is pumped in by a small engine at a pressure which can be adjusted up to over 8 pounds, through a small valve, which takes the place of the ordinary diaphragm, into the trumpet. The valve consists of a number of small slots, covered with a fine comb, not unlike a mouth organ, and the vibration of this comb produces the sound. On a calm, windless day, it is estimated that, with a high pressure, the record could be distinctly heard three miles away.

Constitution of Meteorites.—The meteorite of the Cañon Diablo has been examined by MM. Moissan and Osmond, who have demonstrated that in the parts which appear homogeneous nuclei are met with formed of superposed layers of ferric phosphide and carbide. Also, the study of the nodules has shown that these are formed of troilite; that is, ferric sulphide, surrounded with successive layers of phosphide and carbide. The composition of this meteorite is therefore quite complex and the micrographic examination justifies the conclusion that the metallic mass has been submitted to violent pressure. In some of the nodules the troilite has been, as it were, laminated and has taken on a schistose structure.

Prof. Flinders Petrie, the eminent Egyptologist, has made some important discoveries in the Sinai peninsula. The ancient temple of Seabit el Khadem, five days' camel journey south of Suez, he found to be of a Semitic type, different from any other known Egyptian temple, possessing two courts for ablution, and a long series of subterranean chambers, added by successive kings from the eighteenth to the twentieth dynasties. Many previously unknown hieroglyphic inscriptions relating to mining expeditions in Egypt were also brought to light by Prof. Petrie, who also found a very fine sculptured portrait of Queen Thy. The latter discovery is particularly interesting in the light of the recent opening of the queen's tomb at Luxor on the Nile.

Sir William Ramsay gave an account, at the Royal Society, of the quantities of neon and helium, gases discovered by him, which is interesting as showing the extremely small amounts with which modern physical chemistry can deal. First, argon, it will be remembered, was found by Lord Rayleigh and himself to lurk in atmospheric air; then helium, a substance which had been detected by the spectroscope in the sun, was identified in the earth's atmosphere. Next, three other gases were revealed—krypton, xenon, and neon—hiding themselves also in very minute quantities. Some time ago Sir William Ramsay communicated to the Society estimates of the amounts of krypton and of xenon in atmospheric air, and since then he has been doing the same for neon and helium. After a series of delicate investigations, which he described, he arrived at the conclusion that there are in gaseous air 86 parts by weight of neon in a thousand million, and 123 parts in the same by volume, while of helium there are 56 parts by weight in ten thousand million and 400 by volume in the same. Such minute amounts seem almost incalculably small, but corroborative tests had been applied, which indicated that the estimates could not be far from accurate.