The discovery of ancient sculptures has revealed to us much that was vague and uncertain before. The Assyrian bas-reliefs formerly forming sculptured slabs in their architectures many of which, either originals or copies are now in the British Museum, have been most valuable in throwing light on their modes of construction. It was supposed that they had knowledge of mechanical powers and appliances of which we know nothing, else people asked how could they raise the mighty structures they did. If they had, it is singular that we have no trace or reference to such, but on the other hand in these sculptured bas-reliefs we have representatives of the transporting and raising of immense columns, and huge winged bulls and such like, and how is it done? Simply by the application of the simplest of our mechanical forces, the inclined plane, the roller and lever, possibly the pulley, and brute force.

Hundreds, nay thousands of slaves are there sculptured, dragging at the chains, and kept to their work by the lash of cruel overseers, columns are now raised by the slow process of ramming earth under them until they were got to the perpendicular. Human life was of no importance in those times, and the stones may almost be said to have been cemented with blood.

In Egyptian architecture they embodied some noble sculpture, entwining with the grosser materialism symbolic representatives of eternity, resurrection and notably in those strange majestic Sphnixes, their conceptions of deity, or sovereignty of the universe—the wings of the eagle, the king of birds, the body of the lion, the king of beasts, the head of man—the highest type of intelligence.

In Chinese, Japanese and Indian sculpture you have representatives of the whole hierarchy of their gods as they lived in fabled story.

But it is to Greece that we turn for ideal sculpture. The Greeks brought the representation of the human form to as nearly perfection as it seems possible to attain as far as its physical aspect is concerned. Their refined and beautiful statuary has been the admiration of the world since. Who that has seen the grace and beauty of the Venus de Milo or of de Medici, the strength and the lithesomeness of the Apollo Belvidere, the half-man half-animal aspect of the marble Gam, the marvellous modelling of muscles as shown in the Wrestlers, the Dying Gladiator, the statues of some of the Cæsars, the frieze of the Parthenon, and many others, but will feel that the men that moulded and chiselled these forms were no ordinary men.

The Elgin marbles, as they are called, or more properly, the horsemen sculptured on the frieze of the Parthenon, and now in the British Museum, are well known. It is said that a riding-master took his class one morning to where they are hung along the walls and said :—"Gentlemen ! Sit down and study the attitude and grace and easy seat of those riders to-day, and you will learn more from them as to what good riding is, than I can teach you !" We found that the architecture of the Greeks was a self-satisfied thing—elegant, refined, placid, but cold—and such is their sculpture. They never cared to express profound emotion. They preferred to depict life in its easy-going, irresponsible, pleasant, sunny aspect, only here and there as in the powerful group of the Laocoon or in the pathetic 'Dying Gladiator' or 'ancient Briton' as it should rather be called, did they strike a deeper chord. Passion they endeavour to banish, aspirations after the divine they understood not, the worship of humanity was personified in their sculpture as in their temple.

(To be Continued.)

ON THE PHYSICAL CONDITION OF IRON AND STEEL

(Tr. Inst. M. E.)

BY PROFESSOR D. E. HUGHES, F.R.S.

In a paper read before the Royal Society, 5th May, 1879, entitled "On an Induction Currents Balance, and experimental researches made therewith," the author showed that this instrument was extremely sensitive to all molecular changes in metallic bodies. Finding that its powers were remarkably suitable for researches upon the molecular change which takes place in Iron and Steel when tempered, he made it with a series of researches to determine the cause of tempering in steel. The results of these he laid before the Institution of Mechanical Engineers (Proceedings 1883, p. 72) in a paper "On the Molecular Rigidity of Tempered Steel." In that paper he advanced the theory that the molecules of soft iron were comparatively free as regards motion amongst themselves, whilst in hard iron or steel they were extremely rigid in their relative positions.

The author has since widened the field of research so as to embrace all the physical changes which occur in iron and steel through chemical alloys, mechanical compression or other strains, annealing, and tempering. The result of these researches he now embodies in the present paper. Believing it necessary that we should be able to tell the physical state of any piece of iron, without destroying or changing that state, he has sought for and tried several methods which gave any hope of success in this direction. The physical state of iron has a marked influence upon its electric conductivity. The differences thus indicated however are not wide enough to be appreciated except with metal in the form of a wire; and in order to perceive small changes, such as small differences of temper, we should require a wire at least 250 yards in length. The author has found however that by the application of certain phenomena belonging to magnetism we are ennabled to perceive clearly the slightest change in the molecular structure of iron or steel, through all degrees of annealing to the finest differences in tempering, and this with pieces of any form or dimensions.

It is already known that soft iron will take a higher degree of magnetism, and retain it less, than steel; and that tempered steel retains magnetism more than soft steel. Consequently we might expect that, by the aid of an instrument which could give correct measurement of degrees of magnetism, we should be able to include all varieties of iron and steel, between the two extremes of softness as in annealed iron, and hardness is in highly tempered cast-steel. The author soon found that this was not the case when pieces of iron were magnetized to saturation, or even partially so.

In a recent paper upon the theory of magnetism the author said, "During these researches I have remarked a peculiar property of magnetism, viz., that not only can the molecules of iron and steel be rotated through any degree of arc to its maximum or saturation, but that each molecule, whilst it requires a comparatively strong force to overcome its rigidity or resistance to rotation, has a small field of its own through which it can move with excessive freedom, trembling, vibrating, or rotating through small arcs with infinitely less force than would be required to rotate it permanently on either side. This property is so marked and general that we can observe it without any special iron or apparatus."

The author has found, by employing extremely feeble magnetizing powers,—such as a weak current of electricity only just sufficient for measurement, or the current from one Daniell cell reduced (as found best for the dimensions of the iron) by passing it through resistance-coils varying from 10 to 100 ohms,—that the following laws hold with every variety of iron and steel :—

1. The magnetic capacity is directly proportional to the softness, or molecular freedom.