the Great Western of England. With reference to which, he says, "I am not aware of any advantage whatever that it has. It has I think several disadvantages. The first of course is the additional expense of construction. It requires embankments and cuttings four feet wider, in consequence of the guage. * * Their tunnels are of course necessarily increased beyond what is sufficient for the narrow guage. The narrow guage tunnels are twenty-four feet wide, that is six feet between the rails, and four feet between the rail and the wall of the tunnel; that makes twenty-four feet. Now of course to give the same space between the rails, and the same space between the outside rail and the wall, it requires the wide guage tunnel to be four feet wider. * * *

(To be continued.)

Views on the Origin of Terrestrial Magnetism.*

The earliest view of terrestrial magnetism supposed the existence of a magnet at the earth's centre. As this does not accord with the observations on declination, inclination, and intensity, Tobias Meyer gave this fictitious magnet an eccentric position, placing it one-seventh part of the earth's radius from the centre. Hansteen imagined that there were two such magnets, different in position and intensity. Ampere set aside these unsatisfactory hypotheses by the view, derived from his discovery, that the earth itself is an electro-magnet, magnetised by an electric current, circulating about it from east to west, perpendicularly to the plane of the magnetic meridian; and that the same currents give direction to the magnetic meridian, and magnetise the ores of iron; the currents, being thermo-electric currents, excited by the action of the sun's heat successively on the different part of the earth's surface as it revolves towards the east

A long time before the discovery of electro-magnetism, Biot was occupied with this subject, and regarded the terrestrial magnetism as the principal resultant of all the magnetic particles disseminated in the earth. M. Gauss adops this view, as an interpretation of the fact, without explaining it. An observation which I made some years since along with one of my brothers has directed my attention to this subject. It related to the fall of a cylindrical meteor whose position was sensibly in the plane of the magnetic meridian. Many luminous meteors have been observed in this same position or near it, if I may judge from some of those described in the catalogue of Borguslawsky.[‡]

The special position of the meteor observed by my brother and myself was not fortuitous; it was determined by the magnetic action of the earth, an action which may be powerful in its influence on meteorites consisting essentially of the magnetic metals, iron, and nickel. In our view, the terrestrial magnet, the earth, decomposed by its influence the normal fluid of the meteoric mass, and so gave the meteor thus polarized the direction of a compass-needle.

In generalising from this fact, and recalling the experiment of **A**rago on the magnetism developed when a magnet acts upon a turning disc, we ask whether the magnetic polarity of our planet - hay not be due to a like cause. Considering it, as proved,

that the sun is polarized magnetically like the earth,§ the sun will then be the inductor magnet, the agent which decomposes the magnetic fluid of the terrestrial globe; it will be to the earth, what the earth was to the meteor. This explanation does not resolve the difficulty, as it does not say whence comes the magnetic polarity of the sun. It implies the intervention of a magnet whose intensity is superior to that of the sun, acting on this last by induction, and impressing a polarity which the sun transmits to other planets of the system. It is the hypothesis reversed of the central magnet, for it places in space the magnetic mass which some physicists have supposed to exist within the earth.

The real cause of the magnetic polarity of the planets, is in my view the same for all, and Arago's experiment conducts to it in a straight line. It results even from the condition of their existence. Each star turning around a central axis, and in determinate curves, is influenced by the mass of these stars and their velocity at the circumference; in a word, the agent decomposing into two fluids the normal magnetism of the carth and the other planets, is their rotation. A geometer examining this opinion, would find, we believe, that the declination, inclination and the perturbations of the magnetic needle, are explained on this hypothesis much better than on any other.

Since my resourches on circular electro-magnets and in general on bodies in rotation, I have sought much for experimental demonstration of this theory, and have now the conviction that this is impossible, as it is not possible for us while upon the earth to remove ourselves from the action of its own magnetism. Whenever a development of magnetism under the influence of rotation is observed, it is common to attribute it to the inductive action of the earth, rendered so striking by the experiments of Arago and Mr. Barlow.

Alongside of the different sources of magnetism mentioned in Treatises on Physics,—friction, pressure, percussion, torsion,—we should add rotation, a mechanical action of equal title with the preceding, and whose effects, produced through a subdivision like that of magnetic polarity, are found grouped at the extremities of the axis in rotation; in the same manner as the poles develope at the extremities of a bar of iron when it is subjected to torsion.

Ingenious application of Science and its Results.

A very ingenious application of scientific principles to determine the point of fusion in a closed vessel, and a remarkable result from high pressure on fluids, were incidently mentioned by the President of the British Association in his inaugural address. Experiments were instituted by Mr. Hopkins, Mr. Fairburn, and Mr. Jowle, to determine the effects of increased pressure in raising the temperature of fusion. The substance operated on was inclosed in a very strong metal chamber, and the pressure was produced by water forced by a plunger acted on by a long lever down an iron tube, three quarters of an inch thick. Wax was the substance employed; and it was of course essential to ascertain the exact moment that it became fluid when heat was applied. As all the apparatus must necessarily be opaque, the melting point could not be seen. The difficulty was ingeniously surmounted in the following manner: a small magnet was enclosed on the top of the wax, whilst outside the metallic chamber containing it, and on the same level, a nicely-balanced

^{*} Silliman's Journal, correspondence of J. Nickles.

[†]Poggendorff's Annalen, vi. 1.

^{\$} See Proceedings, Brit. Assoc., 1653, Sept. 7, Report of Col. Sabine.

[§] Sur la chute d'ume bolide par M. N. Nickles and J. Nickles, Compt. Rend. de "Acad, xix. 1035.