ical treatise steel in general must be regarded not as a definite compound by the nature of its constituent parts, but as a particular state of iron produced by the union of this metal with bodies the nature of which is variable; and it is from this point of view that, after defining steel, independently of all scientific considerations, as an iron which is hardened by tempering, I discriminate in my fourteenth lesson on "Chemistry applied to Dyeing," published in 1829, p. 78:—

1. Steels formed by iron and carbon;
2. Steels formed by iron, carbon, and a third body;
3. Steels formed by iron and some other body, which is not carbon; or uncarbonized steels.

The results of M. Fremy's interesting experiments are, it seems to me, easily connected with what is already known of steel, if looked upon from the point of view I have explained, instead of regarding them in the general way. It is now important to find out—1, Whether it is true, as Guyton says, that diamond dust will turn iron into steel; 2, Whether acieration can be effected without the intervention of nitrogen.

M. Fremy said, in reply to the preceding observations, he was happy to observe the interest the Academy took in his inquiries on steel, and he thanked its members for the friendly way they had spoken of his labors. It was not his intention to treat, in the present communication, of the influence exercised by nitrogen and carbon on the properties of iron, but all questions relating to the fabrication of steel and cast iron had for a long time been carefully studied in his laboratory, and the results would by-and-by yield materials for papers bearing on the following points:—

1. The relative proportions of nitrogen and carbon required to be introduced into iron to form good steel;
2. Circumstances opposing acieration or altering the qualities of a steel when formed;
3. The mode in which carbon penetrates the metallic mass;
4. The reason why such small quantities of carbon and nitrogen can convert iron into steel;
5. The study of steels containing metals such as manganese, chromium, tungsten, aluminium, &c.;
6. Classification of different kinds of cast iron; examination of the effect which silicium, phosphorus, arsenic, and sulphur exert upon these compounds; study of the cast iron best suited to the fabrication of puddled steel.—*Comptes-Rendus.*

On a Standard of Length By HENRY HENNESSY.

From the London Athenæum, June, 1860.

Mr. Taylor's letter, in your last number, has called to mind certain points which I had omitted in my communication of May 5. The calculations referred to by Mr. Yates in his "Essay on a Standard of Length," were deduced by me from the results and formulæ of Bessel, in his "Memoir on the Elliptic Spheroid of Revolution which most

nearly corresponds with the Existing Measurements of arcs of the meridian," "Taylor's Scientific Memoirs," vol. ii., and "Astronomische Nachrichten," No. 333. As my results have not been published, I may be permitted to refer to such as bear upon the matter under discussion. I assumed the one-hundred-millionth part of the earth's axis as the proposed standard of length, instead of the forty-millionth of a meridian, which constitutes the French metre. I found the length of the proposed metre to be about 5·004774 English inches; in other words, I made the polar diameter of the earth to be about 500,477,400 instead of 500,491,440, referred to by Mr. Taylor and Sir John Herschel as the result obtained by the Astronomer Royal. My result makes the millionth part of the earth's axis still closer to five hundred inches than that to which attention has been called in your pages. At the time I communicated my calculations to Mr. Yates, I was not so much struck by the coincidence between the proposed metre and the British inch as to call particular attention to the matter. Although the circumstance appeared interesting and valuable, I still regarded it as only a coincidence; and I fully concur with the judicious remarks of Col. James, in the *Athenæum* for May 19, as to the desirableness of not attaching exaggerated importance to accidents of this kind.

A subject immeasurably more important is touched on by Mr. Taylor, when he speaks of the advantage of saving the country from the French metre. In so far as the metre is less perfect, as a scientific result, than the fraction I have deduced from the earth's axis, I concur with him; but in so far as it is merely French, I cannot assent to his conclusion. Many years after the publication of the *Principia*, it was a point of national honor among a certain set of French *savans* to prefer the vortices of Descartes to the so-called British system of gravitation. Have we all an equal right to smile at this kind of patriotism?

But if the metre happens to be French on account of its derivation from a measurement across France, it is not at all true that the system of measures associated with it is essentially French. I refer to this because any remarks touching the metre are frequently applied to the whole metrical system. The decimal arrangement of that system is as much common property to the mental habits of the members of the ten-fingered human race as the earth's axis is common to the various countries on which they exist. I hope, therefore, that questions of nationality will be as completely excluded from discussions of this kind as they have long happily been from other portions of the exact sciences.

Wynnefield, Rathgar, June 5.

Improved Steam Engine Indicator.

M. Bourdon has successfully applied the flat bent tube of his steam gauge to a steam engine indicator, the action of which is, we learn, all that can be desired. The card is carried on a flat plate which is made to rise and fall at each double stroke of the piston.