was so. The remains of primitive architecture in Greece—particularly at Tiryns—show that wood must have entered largely into architectural constructions; amongst other evidences, the traces of wooden door-cases cannot be explained away. Perrot and Chipiez, with whatever amount of fancifulness there may be (and there is no doubt much which is altogether hypothetical) in their restorations, do come legitimately to an explanation of the Doric guttæ both under the triglyphs and beneath the mutules, as typical of the ends of wooden pegs or trenails in timber construction, which is sufficient for the argument in the review, in which there was no intention to approve Perrot and Chipiez' restorations and deductions any further than that.

(2) As to the second objection taken to the review—the remark respecting the cupola of St. Paul's. The remark in the review had reference to the objection that the external outline of the dome was distinct from the internal, and not to the question of support of the lantern; but with reference to the latter point, when the lantern of St. Peter's is quoted as supported by a more legitimate construction than that of St. Paul's, it may be asked: Why the construction of St. Peter's dome, which is absolutely dependent for its safety on the iron chains by which it is hooped together, is preferable to that of St. Paul's, where the lantern has a much securer, and therefore not less legitimate, support in Sir Christopher Wren's cone?

(3) One remark only on the objection raised to the style of Milan Cathedral. The detail is said to be wretched. That it does not conform to the canon of Northern Gothic can be readily conceded, but that the shafts of the magnificent forest of pillars which support the interior are wretchedly designed, and unsuitable to the intended effect, is not so easy to admit.

THE REVIEWER.

Do the Components of Compound Colours in Nature follow a Law of Multiple Proportions?

THIS question, put by Mr. F. Howard Collins in *NATURE* (p. 438), may be answered in the negative.

In practical work there is no indication of such a law. It is found that the two rays, which together produce a compound natural colour, may be in any proportions; when there is a multiple proportion, and in some cases there must be, it is only as forming part of a series of variations, such as are frequently found within the limits of a single popular colour term. How wide these proportions may be, can be illustrated by comparing them to the varying proportions of two irregular curves towards each other.

The examples of foliage quoted can only be taken as representing individual instances. Variations of climate, age, cultivation, and aspect alter the colour proportions of a given variety of leaf; indeed, such variations are sometimes found in the same leaf.

JOSEPH W. LOVIBOND.

Salisbury, September 23.

IN view of the letters, recently printed in *NATURE*, by Mr. H. H. Pillsbury and Mr. Herbert Spencer, it may be well to state that Chevreul published an "Exposé d'un moyen de définir et de nommer les couleurs d'après une méthode précise et expérimentale" (Paris, 1861, also *Mem. de l'Acad.* xxxiii.), in which elaborate charts are given showing the colours defined by a decimal system and in ten degrees of saturation.

Recently Prof. W. Hallock, of this College, has painted discs with standard colours, and determined their wave-lengths with the spectroscope. These discs were then used to study 6000 samples of coloured objects, and formulæ were determined for some 500 named colours. These formulæ have been used for defining the names of colours in the new "Standard Dictionary" (Funk and Wagnall's, New York).

J. McKEEN CATTELL.

Columbia College, New York, September 20.

A Problem in Thermodynamics.

IT may interest some of your readers to know that the problem in thermodynamics, propounded by Mr. Blass in your number of August 29, has actually been put to the test. I pointed out Mr. Blass's letter to my brother, who is a freezing engineer, and he showed me a copy of the *Zeitschrift für die Gesammelte Kälte-Industrie* (Munich) for August, in which an

account is given of a machine on exactly the principle Mr. Blass suggests, by which Herr Linde has succeeded in liquefying air. It would appear, therefore, that the "theoretical minimum of temperature produced at C" would be determined by the point of liquefaction of the gas employed; with a perfect unliquefiable gas it would, I suppose, theoretically, be absolute zero.

EDWARD T. DIXON.

Cambridge, September 22.

THE NEW MINERAL GASES.

OUR knowledge of the spectra and other conditionings of the new mineral gases has received an important addition in the communication from Drs. Runge and Paschen which appeared in last week's *NATURE*. The employment of exposures extending over seven hours has given a considerable extension in the number of lines, and the bolometer has been called in to investigate lines in the infra-red; better still, they have employed well-practised hands in searching for series of lines. Operating, by chemical means, upon a crystal of clèveite free from any other mineral, they have obtained a product so pure that from these series there are no outstanding lines. Very great weight, therefore, must be attached to their conclusions, and there are several points of contact with the work upon which I have been engaged from a slightly different stand-point since last April, when Prof. Ramsay made his fortunate discovery of a terrestrial source of helium.

I will touch upon some of these points *seriatim*.

In the first place, there has never been the slightest doubt in my mind that it was a question of gases and not of a gas. The spectroscopic evidence in the laboratory alone was complete, and the case was greatly strengthened when the behaviour of the various lines in the sun and stars was also brought into evidence. Drs. Runge and Paschen also declare that the gas given off even by a pure crystal of clèveite is not simple, but consists of two constituents. To the one containing the line D₃, which I discovered in 1868, the name helium remains; the other for the present, we may call "gas X." The chief lines of these two constituents are as follows, according to Runge and Paschen:

Helium.	Gas X.
5876	6678
4713	5048
4472	5016
4026	4922
3889	

Last May I wrote as follows¹ :—

"The preliminary reconnaissance suggests that the gas obtained from bröggerite, by my method, is one of complex origin.

"I now proceed to show that the same conclusion holds good for the gases obtained by Profs. Ramsay and Clève from clèveite.

"For this purpose, as the final measures of the lines of the gas as obtained from clèveite by Profs. Ramsay and Clève have not yet been published, I take those given by Crookes, and Clève, as observed by Thalén.

"The most definite and striking result so far obtained is that in the spectra of the minerals giving the yellow line I have so far examined, I have never once seen the lines recorded by Crookes and Thalén in the blue. This demonstrates that the gas obtained from certain specimens of clèveite by chemical methods is vastly different from that obtained by my method from certain specimens of bröggerite, and since from the point of view of the blue lines, the spectrum of the gas obtained from clèveite is more complex than that of bröggerite, the gas itself cannot be more simple.

"Even the blue lines themselves, instead of appearing

¹ *Proc. Roy. Soc.*, vol. lviii. p. 214.