gratulated on the fair and temperate manner in which they have brought their case before the court of public opinion. Pain and suffering are unfortunately inseparable from the lot of many kinds of domesticated animals, as well as of those wild species which are hunted for sport or for their spoils; but it is the bounden and paramount duty of all civilised nations to see that these are reduced to the smallest possible minimum. Those who read this book—and it is, for the most part, at any rate, very painful reading—will, however, be convinced that even in our own country matters too often are by no means as they should be in this respect. In fact the authors have, unhappily, in many instances, a very strong, and in almost every instance a very sad, case; and it is sincerely to be hoped that their book may be the means of bringing to pass a better state of affairs in regard to our treatment of the lower animals in such cases as amendment and amelioration are most urgent and at the same time practicable. Apart from the ruthless slaughter of birds for their plumage—accompanied too frequently by the lingering starvation of their helpless young—one of the worst and most pitiable cases in the whole sad story is the treatment meted out to worn-out horses; and it must indeed be a hardened heart which is not rent by the illustrations depicting these wretched animals on their last journeys. Fortunately, several European Governments are already awake to the need of stringent measures to remedy this crying evil, and we trust the present volume may give a further stimulus to their efforts.

R. L.

Les Moteurs Thermiques dans leurs Rapports avec la Thermodynamique. Moteurs à explosion et à Combustion. Machines Alternatives à Vapeur. Turbines à Vapeur. By F. Moritz. Pp. vi+297. (Paris: Gauthier-Villars, 1913.) Price 13 francs.

IN writing this book on heat engines the author has divided very unequally the space given to engines operating with external combustion and those in which combustion takes place inside the cylinder. By far the larger part is given up to the steam engine, and particularly the steam turbine. As is usual in French books, mathematical analysis is the natural line of approach to any difficult problem, however obscure the relationship of theory and practice. The book is divided into six chapters, of which the first two relate to the laws of thermodynamics—and a very careful and complete statement of them is given—to gaseous cycles and to a concise explanation of what is meant by entropy.

The twenty-five pages of chapter iii. are made to suffice for the application of preceding theory to the gas engine, and as a natural consequence of such compression the conclusions reached are incomplete. The gaseous mixture used in the gas engine is throughout assumed to have a specific heat quite independent of all temperature changes—an assumption which naturally removes almost all practical value from any conclusions which may be arrived at on theoretical grounds. The chapter concludes with the following quaint suggestion:—"On peut en tirer des conclusions practiques intéressantes, par example, sur l'influence de la circulation d'eau autour des cylindres. Nous laissons au lecteur le soin de faire cette comparison pour tous les cas qui peuvent se présenter à lui."

Chapters iv., v., and vi. (some two hundred pages) are given up to piston steam engines and steam turbines. The author shows much skill in his analysis of the theory of jets and of turbine flow; he treats very fully also of turbine leakage, and uses freely the entropy diagram to illustrate his meaning. Students of the steam turbine will find M. Moritz' book both interesting and stimulating.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Spectra of Helium and Hydrogen.

WITH regard to Mr. Evans's communication to NATURE, September 4, p. 5, I should like to remark that while I have for some time recognised that the experimental evidence, on the whole, seems to be in favour of helium as the origin of the new lines 4686, &c., it should not be too hastily concluded that they are not due to hydrogen. Mr. Evans appears to have succeeded in eliminating the ordinary spectroscopic indications of hydrogen from his helium tubes, but is it not possible that, under the special conditions of the strongly disruptive discharge, with helium also present, residual hydrogen may be represented only by the new lines? This would not be the only known case in which the presence of helium aids the development of the spectrum of another gas with which it is mixed. I have observed this effect in the case of the series of bands of carbonic oxide which are characteristic of the tails of comets; these bands are of very feeble intensity at the low pressures necessary for their approximate isolation in the spectrum of the pure gas, but I have seen them greatly intensified when carbonic oxide was present as an impurity in helium. Also, the Ritz series of infra-red hydrogen lines was found by Paschen to be brighter in a mixture of hydrogen and helium than in hydrogen alone. Apart from this, I find it difficult to believe that the close agreement of one set of lines with the principal series calculated for hydrogen by Rydberg is merely accidental.

Dr. Bohr's theory (*Phil. Mag.*, July, 1913) does not at present seem to me to give much evidence for helium, in preference to hydrogen, as the origin of the lines in question. The formula derived from the theory gives no better agreement with the observations than that of Rydberg, so far as the two are comparable, and apparently requires that the seven observed lines, beginning with 4686, should be capable of arrangement in a single series. I think, however, that the lines cannot be so united within the limits of error of observation, though very nearly so, and I believe that my separation into two series converging to the same limit is correct. The necessity for two series is rather more clearly indicated in the case of the analogous series of magnesium spark lines

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which I have lately described (Proc. Roy. Soc., vol. lxxxix., p. 133). Moreover, the merging of two such series into one formula is open to the objection that it involves multiplication by 4 of the series constant, which would otherwise be universal. It may be possible, however, to test this point by observations of the Zeeman effects on the lines, and I shall make this experiment at the first opportunity.

I may add that experiments made by Prof. Strutt and myself are in harmony with those of Mr. Evans in showing that the lines under consideration do not occur in mixtures of hydrogen with neon or argon.

A. FOWLER.

Imperial College of Science and Technology, South Kensington, September 13.

The Elephant Trench at Dewlish—Was it Dug?

THE Rev. Osmond Fisher makes the interesting suggestion that the curious trough at Dewlish, in which numerous remains of *Elephas meridionalis* were found, was an artificial trench, dug as a sort of pitfall to intercept and disable wild animals driven across it. Perhaps, as having seen the excavations made by Mr. Mansel-Pleydell, I may say a word on this point.

Open trenches in the soft chalk are unknown elsewhere, though they are common enough in the hard mountain limestone. I therefore examined this trench most carefully, in order to find out how it had originated, and whether man had had anything to do with it. I am still much puzzled as to its exact mode of excavation; but certain peculiarities convinced me that it was due to natural agencies, and that it was probably cut by the swirl of the fine dust-like quartz-sand which, mixed with polished flints, now fills its lower part. I could find no implements, and could nowhere see traces of pick marks. The sides of the trench, where not damaged by the workmen who had just cleared it, were curiously smooth; but the flint-nodules projected into the cavity from either side, as though the softer chalk had been scoured away. The abrupt rounded end of the trench was most peculiar, and as I cleaned this out myself, dusting away the sand from the smoothed face of the chalk, I am sure that there were here neither tool-marks nor rubbings such as might be made by a man working in the trench, or by wild beasts. In short, the smooth, rounded contours suggested the eddying of wind, and the absence of any crack or joint showed that here at any rate the rounding was not likely to be due to percolating water.

Beneath the elephant bones, which occurred in a layer a few feet down, the infilling of the trench seems to be a fine dust-like, unfossiliferous sand, which was not bottomed, as Mr. Mansel-Pleydell's excavations were made primarily to obtain elephant remains, and these were in such a soft condition as to make removal almost impossible. If this sand-filled fissure is found to continue downward, but is too narrow for a man to work in, it will show that the trench is not artificial. I could only just squeeze past in one or two places; but the upper part of the trench was passable; I think, however, that it tended to narrow downward, but at the time of my visit the bones had not been removed, and I could not excavate below them.

Perhaps someone acquainted with plateaus of soft limestone under desert conditions can say whether there is any tendency for the wind to cut trenches with rounded blind ends, such as the Dewlish trench has. In this connection, it is worth noting that our newer Pliocene land-faunas show distinct indications of drier and more sunny conditions than we have at present. A gazelle, an antelope, and several land and fresh-water mollusca point in that direction. Under dry conditions, and before the loose flints were swept away during the glacial period, our chalk-downs would probably be stony deserts, quite unlike the green hills we now see.

CLEMENT REID.

Milford-on-Sea.

Red-water Phenomenon due to Euglena.

THE red-water phenomenon due to a Euglena described by Prof. Dendy in NATURE of August 7 has been observed by me in Pretoria. In this case, however, the Euglena swims freely about in the water, and also forms a red gelatinous scum on the surface of the damp mud on the side of the pond. In swimming they seldom show euglenoid movement. A flagellum longer than the body can be easily seen under the microscope at the anterior end of the body, but it always trails along the body with lashing movements. If they become stranded on the mud at the edge of the pond, they soon become spherical and encysted in a mucilaginous covering much wider than the body and showing a layered formation. I have not observed any bubbles of gas given off, although I have kept large quantities of them under observation for long periods. They appear to prefer the encysted form, as they always swim to the edge of the vessel towards the light and form a deep red line along the edge, which gradually becomes dry. If more water is added and the vessel turned round, they will leave their cysts and again swim towards the light side. They are of a fairly large size, and have a cylindrical body tapering to a sharp point at the posterior end, where the last portion is free from pigment Chlorophyll is present, and is easily seen amongst the red in those that have just come out of the encysted stage, but later on it entirely disappears.

HORACE A. WAGER.

Transvaal University College, Pretoria. August 30.

Distance of the Visible Horizon.

MR. W. MOSS'S account in NATURE for August 7, p. 583, as to how to get the area of a sphere theoretically visible at any altitude is interesting; but can he, or any of your readers, say what the formula is for obtaining the distance actually visible with an average amount of refraction? So far as I can discover, all ordinary books of tables ignore this, although such a table would be very useful.

A table is given in Chamber's Mathematical Tables, p. 436, for the distance of the visible horizon, but the explanation, p. xl., states that this is theoretical, and that a correction for refraction should be made, although nowhere is any table or formula given for such correction.

T. W. BACKHOUSE.

West Hendon House, Sunderland September 6, 1913.

ATMOSPHERIC refraction is such a varying quantity that no rule respecting it can be laid down applicable in all circumstances; as in cases of mirage, for instance, where vessels below the horizon are seen standing above it, and turned upside down. The refraction of the sea horizon is the great difficulty in obtaining correctly the position of vessels at sea. This can be eliminated in most cases by taking observations of the heavenly bodies to opposite sides of the horizon; for latitude in a north as well as in a south direction; for longitude in an east as well as in a west direction. When only one heavenly object is available this is not always practicable, but it can be done when the altitude is 60° or upwards.

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