than with either physics or chemistry. Without a sound knowledge of at least the fundamental principles of these two sciences, the scientific treatment of smoke abatement is bound to suffer, and the result is that the scientific part, if it may be so called, is ill expressed and arranged, incomplete, and often incorrect. For example, the term "British Thermal Unit" is defined and used; but the method of estimating the calorific value of fuels is never mentioned, or its relation to temperature, though the two are frequently referred to together. The confusion between molecular and atomic weights (p. 16) is not perhaps a serious error, but the statement that at low temperatures "hydrogen and carbon in the coal partially combine, producing hydro-carbons causing smoke" (p. 15), cannot be passed over so lightly. The statement on p. 12 that *excessive admission of air* produces carbon monoxide must surely be an oversight.

The author is evidently more at home with furnaces, boilers, and mechanical stokers, and the fact that he has qualified as smoke inspector by examination of the Royal Sanitary Institute explains the clear and full descriptive account of these appliances, together with various forms of gas-producers and fire-grates. Everyone must sympathise with the vigorous condemnation levelled by the author against smoke and those responsible for it, but we doubt whether the volume before us, either by suggestion or experiment or new appliances, has thrown very much fresh light on the problem, or added many facts to those already known. J. B. C.

Laboratory Manual of Bituminous Materials for the Use of Students in Highway Engineering. By Prévost Hubbard. Pp. xi+153 (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 6*s.* net.

SINCE the advent of the motor-car the use of bituminous materials in road-making has become more and more widespread, and a definite knowledge of the chemical and physical characters of these substances is of increasing importance to the road constructor. In the United States a number of the leading universities have instituted courses of instruction in highway engineering, which include laboratory practice in the testing of bituminous materials, and the manual under notice has been prepared by the author to meet the wants of students and instructors attending such courses.

The first part of the book deals with the definition and classification of the various bituminous substances used by the highway engineer, and also with general matters such as the sampling and preparation of the bitumens for analysis. In the second and main division the author describes the methods of applying the various tests—chemical, physical, and mechanical—by which the materials are assayed and evaluated. The descriptions are lucid and concise; they have evidently been drawn up by a writer who has first-hand knowledge of the special difficulties attending this class of analytical work. In the concluding part of the book the characteristics of the more important bituminous substances are discussed, including those of the fluid, semi-solid, and solid petroleum products, tars, asphalts, pitches, creosote oils, and bituminous aggregates. Typical analyses are given, and these are carefully dissected in order to bring out clearly the proper interpretation of the results. The book should prove of value to municipal and other chemists who may have to deal with the substances in question, as well as to the students for whom it is especially written. C. S.

THE DANGERS OF ELECTRICAL CURRENTS.

ON account of the widespread use of electricity at the present time, the small book before us, by M. Rodet,[1] is of considerable practical value. We note that an actual current must pass through the tissues of the body if any effect is to be produced. A static charge is harmless. A bird may perch on a high-tension main without any serious results. The resistance of the human body resides chiefly in the skin, and is very high if the skin is dry—from 20,000 to 80,000 ohms. But if the skin is moist and a good earth contact is made by bare feet in a wet mass, a man may be killed by touching a 100-volt main. A brief summary is given of the general physiological effects of stimulating various nerves by electrical currents. The development of heat is also discussed; burns are produced where the current density is great, as when it enters by a relatively small contact surface. With respect to high-frequency alternating currents, the interesting experiments of Kennelly and Anderson in America are described. They showed that, at an alternation of 100,000 per second, a voltage of 250 can send a current of half an ampere through the body without any sensation beyond that of warmth. The explanation is probably that given by Nernst, namely, that certain ions in the nerves must attain a certain minimal local concentration in order that stimulation may take place. Each half-wave of so rapid an alternation cannot, in the time permitted, effect this concentration before the opposite half-wave comes in and reverses what little has been done. The energy of the current is thus converted into heat without being able to produce electrolytic changes.

The second chapter is devoted to the nature of the accidents which may happen. These are indirect and direct. The former are due to a momentary shock, harmless in itself, but which may cause a fall from a height or similar result. The protection is obvious: to take care either that no live wires are within reach, or that the workman wears efficient insulating gloves, stands on insulators, and so on, if disconnection from the generator is impossible. The *direct accidents* are due to actual passage of current through the body. So many different effects are possible that it is frequently a matter of difficulty to say what

[1] "Actions Physiologiques et Dangers des Courants Électriques." Par J. Rodet. (Paris: Gauthier-Villars et Cie, 1917.) Price 3.25 francs.

a particular case may be suffering from, and an autopsy may not reveal the cause of death. An important point to decide, so far as practicable, is what voltage is to be regarded as dangerous. As stated above, the resistance of the skin may vary greatly. But, according to Jellineck, 100 to 150 volts may usually be handled with impunity; 200 to 500 volts are dangerous; anything above 500 volts nearly always causes death. It has been said that 0·1 ampere is fatal, but this is probably the upper limit of safety, and many persons, especially alcoholics, are very susceptible. The time of exposure naturally plays an important part, so that a short contact may be innocuous, while a longer one is fatal. This is partly due to the fact that the resistance decreases during the passage of the current, so that more and more is sent through. Cases where one of the mains is earthed are especially dangerous if contact be made with the insulated main. It appears, however, that the electrostatic capacity of a large circuit may render contact with a completely insulated alternating current dangerous.

The precautions to be adopted are detailed in the fifth chapter. These are partly of the nature of notices of danger placed in the neighbourhood of live conductors and instructions to workmen employed where there is risk of contact. All live conductors should, if possible, be placed out of reach, and all parts liable to obtain static charges, such as the outer cases of transformers, should be earthed. Since it is very rare that *both* mains come into contact with the body, a sufficient protection, up to 500 volts, is usually found in insulating gloves and such like. In the case of alternating currents special danger is incurred when the insulation between the primary and secondary coils of a transformer breaks down, or, in general, whenever a low-tension circuit becomes connected with one of high tension. Various methods of automatic connecting to earth, when this happens, are described. The advantages of connecting one main of the secondary circuit permanently to earth are fully discussed, and the means of making good earth contacts pointed out. Where there is a water main this forms the best of such connections.

The final chapter deals with the treatment of accidents. Burns require the usual dressings and present no special difficulties. On the other hand, the numerous effects of the passage of a current through the body make it difficult to know what has actually happened. The most obvious result is a cessation of respiration and of the beats of the heart. It is almost impossible to say which is the primary cause, since either involves the other. But the treatment is the same, namely, artificial respiration applied as soon as possible, without waiting for removal or for the arrival of a medical man. The report of the American Commission on the best method finds that Schäfer's is to be preferred. One of the most important points in its favour is, perhaps, not sufficiently insisted on: that is, that it can be carried on for a long time without fatigue to the operator. The value of this is shown by some of the cases mentioned, especially one in America, where the patient did not recover until artificial respiration had been carried on for six hours. Some other methods of artificial respiration are described, but, with the exception of the old Sylvester method, they are ineffective and so far mischievous, since they waste time during which an effective method might have been used. If compressed oxygen is available, advantage will be gained by arranging that the gas drawn in by inspiration shall consist of oxygen. As concerns the use of apparatus for insufflation of oxygen, in place of the mechanical movement of the chest, they are no doubt valuable, if at hand. But this is rarely possible, and M. Rodet rightly insists that a less effective method may be successful if used at once, where a more perfect one may be useless if it involves only a few minutes' delay.

The heart sometimes enters into fibrillary contraction. If this is the case with the ventricle, no means yet known are capable of restoring it. It seems that a more direct massage of the heart may in some cases be of use, if it can be done without interfering with the artificial respiration. Intravenous injections of saline solutions containing adrenaline may also be given. By this means a better supply of blood to the heart and brain is brought about by the rise in arterial pressure. It is to be remembered that Schäfer's method of artificial respiration involves, more or less, a rhythmical compression of the heart.

But, even when natural respiration has returned, the patient must be watched for some time, since he may cease breathing again and require renewed artificial respiration. He should be kept warm from the first and, after natural breathing has returned, may be given hot coffee. But on no account must liquids be given until that time. Secondary complications, such as paralysis or renal affections, may cause death days or weeks after the accident.

The author concludes that, in any case, prevention is better than cure, and that every means of avoiding the chance of contact with live conductors should be adopted, both for workpeople and for the public in general.

The book is written with the usual lucidity of French scientific works and should be in the hands of everyone likely to have to deal with the results of exposure to electrical currents.

W. M. BAYLISS.

IMPERIAL MINERAL RESOURCES BUREAU.

AS was briefly announced in NATURE of June 7 (p. 289), the Minister of Munitions has appointed a committee to prepare a scheme for the establishment of an Imperial Mineral Resources Bureau, to be located in London. This is obviously the first step towards carrying out the recommendation of the recent Imperial War Conference: "That it is desirable to establish in London an Imperial Mineral Resources Bureau, upon