

æther may not be thought of as endowed with the physical properties of material media. It must not be considered as either fixed or moving. No explicit use of any conception of the æther is made in the theory of relativity. It is difficult to see what use could be made of the above views, which are chiefly negative. The phenomena of the gyroscope and Foucault's pendulum (and Sagnac's optical experiment), which on the Newtonian ideas are attributed to absolute space, are attributed by relativists to the æther or the effects of the fixed stars—which is rather unconvincing.

VI. WEYL'S EXTENDED THEORY (1918).—Whereas Einstein's interval depends only upon gravitational phenomena (although Maxwell's equations and all electromagnetic effects fit into the framework thus constructed), Weyl assumes that the length of the measuring rod depends upon the route it has taken in the neighbourhood of electromagnetic fields. When these are present, the interval is no longer a definite quantity (thus weakening the argument for the

spectral shift). This theory accounts for Maxwell's equations and introduces Einstein's cosmological term in a natural way, and adds the law of conservation of electricity to those of conservation of momentum and energy. On the other hand, it introduces great complexity into geometry and appears to imply the impossibility of metrology, beyond a certain—very high—degree of accuracy. There is no experimental confirmation. Einstein does not accept it. Eddington (1921) has generalised Weyl's mathematics, but says, "Einstein's postulates and deductions are exact. The natural geometry of the world . . . is the geometry of Riemann and Einstein, not Weyl's generalised geometry or mine."

VII. PAINLEVÉ'S SEMI-EINSTEINIAN THEORY OF GRAVITATION (1922).—This retains Euclidean geometry and the old ideas about space and time. By axioms which are somewhat similar to those of Einstein, but which make no reference to the restricted theory, Schwarzschild's form of  $ds^2$  and the verified astronomical results are obtained.

### Kitchen Ranges.

THERE is probably no more difficult problem presented to the heating engineer than the kitchen range. So complicated is it that it would appear that no single appliance could possibly be constructed to suit every house or even any large number of houses, and that each installation would have to be adapted to the requirements of the special household. For example, a working-man's cottage usually requires only one fire, which, in the absence of a gas cooker, must satisfy the quadruple duty of heating the room, the oven, the hot-plate and the water, whereas a better class of house might use, and with greater economy, a gas cooker and a coke boiler for the supply of hot water and radiators. Then, again, in an ordinary household, cooking is an operation occupying two or three hours per day only, while hot water is likely to be required at any moment throughout the day. Heating of the rooms is required continuously all day in winter, but not at all in summer. The inevitable consequence of such an intermittent demand is a low efficiency.

We have before us two important pamphlets embodying the researches of Dr. Margaret Fishenden and Mr. A. H. Barker carried out under the auspices of the Fuel Research Board.<sup>1</sup> Dr. Fishenden has restricted her investigation to the comparative efficiency of ranges fired with ordinary bituminous coal and those heated with the special coke cakes (low temperature coke) produced by the Fuel Research Station at E. Greenwich. She finds that low temperature coke yields a greater proportion of total heat for radiation or for water heating than bituminous coal, while for oven heating the coke compares less favourably with coal, the advantage of coke being largely due to radiation effects. She finds, moreover, that in an open kitchen range with back boiler about 17 per cent. of the heat of the coal is used for hot water, and in modern designs it varied from 13 to 19 per cent., a result rather higher than that found by Mr. Barker.

It is unfortunate that Dr. Fishenden's experiments do not include ordinary coke, as the low temperature coke prepared by the Fuel Research Board is a commodity not yet on the market and unlikely to

appear there, as it is obviously too costly to compete at present with either coal or coke. The report of Mr. Barker (who is lecturer on heating and ventilating engineering at University College, London) deals in a very comprehensive fashion with the whole subject of kitchen ranges, and the results of a large number of practical tests on old and new designs using coal, coke, and gas as sources of fuel. The introduction to the report contains the following statement: "In the design of British cooking ranges, attention has hitherto been mainly devoted to securing cheapness of construction and convenience of use. Economy in fuel consumption has only played a minor part in determining the different types in use. The shortage and high price of coal have, however, emphasized the necessity for fuel economy and, consequently, of an examination of the efficiency of British kitchen ranges. . . . The strong prejudice in favour of an open-fronted fire appears to be peculiar to this country. In most other countries a cooking range fire is usually closed. . . . In view, therefore, of the scarcity and high price of coal at the present time, it appears to be a matter for serious consideration whether steps should not be taken to encourage the more general adoption in this country of ranges which are more economical in fuel consumption than those of ordinary British design."

In his general summary Mr. Barker has arrived at the following conclusions: that the general efficiency of all ranges on the market at the present time is low, the actual oven efficiency ranging from 0.75 to 5 per cent., the usual being about 2 per cent., that of the hot water supply from 7 to 17 per cent. or usually 11 per cent., and the hot plate from 1 to 12 per cent. or generally below 6 per cent. He estimates that the modern type of range wastes 85 per cent. of the fuel in heating the air of the kitchen (about 30 per cent.), by absorption in the brickwork (about 30 per cent.), and lost in the flue gases (about 25 per cent.). Economy may be effected by not setting ranges in brickwork, by preventing leakage of cold air into the furnace and flues, and by doing away with the hot-plate or covering it when not in use, and also the oven door, with non-conducting material. He admits, however, that these losses are unavoidable if the present convenience and cheapness of the ordinary range are to be retained and one fire made to serve so many different purposes. But if the efficiency is considered irrespective of convenience, cheapness,

<sup>1</sup> (1) *The Efficiency of Low Temperature Coke in Domestic Appliances*, by Dr. Margaret W. Fishenden. Fuel Research Board, Technical Paper No. 3. London: H.M. Stationery Office, 1922. 9d. net.

(2) *Tests on Ranges and Cooking Appliances*, by A. H. Barker. Fuel Research Board, Special Report No. 4. London: H.M. Stationery Office, 1922. 2s. 6d. net.

and space, then it would be necessary to have separate fires for oven, hot water, and hot-plate. This is obviously impracticable; but, on the other hand, in a well-insulated oven heated over a small fire without excess of air by leakage, an efficiency of 30 per cent. might easily be achieved, and, he adds, "there is no reason why a whole dinner could not be cooked in such an oven with 2 lbs. of fuel." But beyond 40 or 50 per cent. efficiency in the oven it is impossible to go, and the ideal conditions can be attained only by electrical heating.

The adoption of an independent boiler would raise the efficiency of the fuel for the hot water supply from an average of 8 to 10 per cent. to 40 to 45 per cent., a figure which Dr. Fishenden gives for a coke-fired boiler. On the other hand, for a small household such a boiler is too large, and a small boiler is difficult to fire and keep alight, especially with coke.

The principal cause of loss from a hot water equipment is not so much the low efficiency of the apparatus as the subsequent loss of heat from the storage vessel by radiation. Hot water should be generated when it is required, and this can be done only by gas as in the gas geyser, which is efficient and useful though clumsy and dangerous. If the appliance can be so arranged that the fire can be lighted and burn itself out, a sufficient supply of hot water would be produced for a whole day's use provided the heat was not allowed to escape by proper insulation.

The report contains a lot more useful, practical information as to the method of installation, but perhaps the most significant and encouraging part of the report is the improvement in efficiency which Mr. Barker has himself effected in ranges of his own design whereby he has reduced the fuel consumption by about 70 per cent. It is to be hoped that this new type of range will soon be placed on the market

J. B. C.

### University and Educational Intelligence.

LEEDS.—The hon. degree of Doctor of Science has been conferred on the following: Sir Charles Scott Sherrington, G.B.E., president of the British Association; the Duc de Broglie, Institut d'Optique, Paris; Dr. C. G. Joh. Petersen, director of the Danish Biological Station, Copenhagen; and Prof. P. Weiss, director of the Institut de Physique, University of Strasbourg.

LONDON.—Mr. T. A. Stephenson of Kingswood School and University College, Aberystwyth, has been appointed assistant in the department of zoology and comparative anatomy at University College.

A programme of public lectures, admission to which is free and without ticket, to be delivered at University College during the coming term, has been issued. It includes lectures on social life in Egypt by Prof. Flinders Petrie, on recent excavations in Malta by Miss M. A. Murray, on the beginnings of science by Prof. G. Elliot Smith, on the nature of intelligence by Prof. C. Spearman, and a series of lectures on phonetics, including one on the nature and reproduction of speech sounds by Sir Richard Paget. At King's College there will be a course of ten lectures by Prof. H. Wildon Carr, commencing on October 5, on the new method of Descartes and the problems to which it gave rise; five lectures by Miss Hilda D. Oakeley on the Stoic philosophy, commencing on November 9; one lecture on October 9, at 5.30, by Prof. G. B. Jeffery on Einstein's theory of relativity; six lectures, commencing October 17, on modern hydro-electric engineering practice by E. M. Bergstrom; and three lectures, commencing November 28, on the fuel problem from an engineering

standpoint by Dr. C. H. Iander. Complete lists of the lectures can be obtained on application, enclosing a stamped addressed envelope, to the secretary of the college in question.

AN article on "The New University of London," by T. Ll. Humberstone, appears in the *English Review* for September. After showing that so far back as the twelfth century there existed in London all the necessary elements for the formation of a great university, and speculating as to the reasons why, nevertheless, it was not until the nineteenth that one came into being, the writer describes the establishment of the University of London as an examining board in 1836 and its reconstitution as a teaching university in 1900. Of the "third incarnation," now inaugurated with the gift by the Government of eleven and a half acres of land adjoining the site of the British Museum, he writes: "Our task is to open a new Pierian spring to quench a world-thirst": the new university of London is destined to play a great part in the re-establishment of the cosmopolitan spirit which, under the influence of the Roman Church, tended in the Middle Ages to make Europe a single nation. Time will show whether these aspirations, stimulated by Mr. Fisher's speech at University College last February, can be realised. Meanwhile there is one obstacle, easily removed, to which attention was directed at the recent conference at Basle of delegates from British and Swiss universities. There London's policy in regard to the admission of foreign students was criticised as illiberal. Why, it was asked, should London insist on verifying, by a special matriculation examination, the attainments of students who hold certificates qualifying for admission without further examination into the universities of Switzerland, and implying matriculation standards of attainment in the subjects of the London examination? Cambridge has lately adopted a comprehensive exemption formula recognising the sufficiency of the standards implied by such foreign certificates, and it was hoped that London would do likewise.

THE University of Colorado Catalogue, 1921-22, issued in March 1922 with announcements for 1922-1923, presents several interesting features, exemplifying recent developments in American State universities. The University Extension Division, organised in 1912, "aims to make the campus of the university co-extensive with the State, in keeping with the new idea that a State university exists for all the people and not for a favoured few alone." It has a Faculty comprising 12 administrative and secretarial officers, besides professors and instructors in the various university departments, and a non-resident staff numbering 31. Among its varied activities are: correspondence courses, in which form one-fourth of the work for the A.B. degree may be taken; class instruction, more or less on the lines of our university extension lecture courses, but qualifying equally with courses taken in the university towards degrees; courses in secondary education; social surveys of towns, with a view to the solution of community problems; business surveys for determining the commercial resources and trade possibilities of a community; visits to stores and firms "for the purpose of rendering individual assistance in meeting business problems." Quite distinct from the Extension Division is a "Summer Quarter" of ten weeks, in which are provided courses, some of post-graduate standard, in arts and pure sciences, engineering, medicine, and law. These, if pursued through the whole quarter, carry the same credit as similar courses in any other quarter.